INVENTORY CONTROL SYSTEM STUDY

Herbert Lee Bartholomew

A MAJOR TECHNICAL REPORT

in the

Faculty of Engineering

Presented in partial fulfilment of the requirements for the Degree of Master of Engineering at

Concordia University
Montreal, Quebec, Canada

April, 1977

ABSTRACT

HERBERT LEE BARTHOLOMEW

INVENTORY CONTROL SYSTEM STUDY

This report describes the enhancements made by the author to an Inventory Control/Reporting System of a medium size manufacturing company over a three year period.

The first section explains the original documents and outlines weaknesses found by the author. The second section illustrates reports currently in use with emphasis on the improvements made to the original reports.

Finally, the author proceeds to outline future planned enhancements and the benefits expected.

Brief mention is made of the latest computerized inventory system - MATERIAL REQUIREMENTS PLANNING.

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LIST OF ILLUSTRATIONS

INTRODUCTION

The author joined Allis-Chalmers Canada Limited in 1966 and has held a variety of positions prior to his assignment in 1972 as Manager, Orders, Parts and Service. His duties included responsibility for the management of $2,000,000 of finished goods inventory.

In this regard, the Company had implemented a new computerized Inventory Control System the previous year to replace the existing Kardex manual system.

As Manager of a staff using this new system, the author first had to learn how it was designed, and then to analyse its strengths and weaknesses. It was the author's responsibility to define what type of system enhancements would reduce error, reduce cost, increase efficiency, simplify reports, and increase the usefulness of the system.

The Data Processing Department was responsible to write computer programs to achieve the results requested by the author.

Initially, effort was concentrated on areas which reduced error or simplified reports. Later, more effort was spent developing the system to provide better management aids. This pattern of increasing efficiency followed by enhancement is evident.

It should be noted that this paper presents a practical solution to a specific industrial problem, and therefore involves a minimum of theoretical inventory control discussion.

Appendix A highlights the chronological order of major improvements which appear throughout the paper as they apply to the reports being discussed.

I - ORIGINAL SYSTEM REPORTS

The following reports comprise the complete inventory system originally introduced:

	DESCRIPTION	ISSUED
I-1	PARTS FILE LISTING	
I-1.1	Parts File Maintenance Error List	Monthly
I-1.2	Parts Update Error Reports	Weekly
I-1.3	Update Parts Master File	Weekly
I-2	INVENTORY STOCK STATUS	Weekly
I-2.1	Inventory File Maintenance Error List	Weekly
I-2.2	Inventory Update Error Reports	Weekly
I-3	REQUISITION RUN	Weekly
I-4	OPEN CUSTOMER/SHOP ORDERS	Weekly
I-5	INVENTORY FORECAST	Monthly

Appendix B describes the Original System Reports in Block Diagram format.

A description of these reports follows:

I-1 PARTS FILE LISTING

This is a complete listing of every item which is stocked by A-CC in part number sequence.

The purpose of the Parts File is to provide complete basic data concerning all parts kept in stock. With this "base information" the inventory control programs and reports can be formulated.

Referring to Figure I-1 the abbreviated headings represent the following data:

PART NUMBER: A drawing number describes each part

CDE

"1" - designates a forecasted item (i.e. when an order point is reached the "computer" will order additional parts on the "requisition run").

"2" - designates a non-forecast item. Here the inventory control techniques are the same, only the computer will not re-order. This code is presently for "special stock" items and for record keeping purposes. It is also used for reference information (i.e. one part no. superceded by another part no.).

TYP

M - designates a manufactured item.

P - designates a purchased finished item.

Z - designates an item both purchased and manufactured.

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PART NUMBER	CDE	TYP	DESCRIPTION		SER.NO	SIZE	PATTERN NO	U/M	LEDGER A/C	COM CL.	BUY CDE	QA CDE	INV CDE	USG CDE	SAF FAC	LD TM	ORD PT	QTY	UNIT COST	ISS.DATE
98232667036	1	Z	SSCSGHRGRING		075282		R47619	PC	0603-31	0	0		0	2	1	12	5	6	14.41	16 05 71
98232668001	1	Z	BRCSGHRGRING DNR		074703		R50375	PC	0603-31	0	0		0	2	1	12	1	6	0.00	16 05 71
98232668004	1	Z	BRCSGHRGRING		144016		R47130	PC	0603-31	0	0		0	2	1	12	1	6	15.22	16 05 71
98232669006	1	Z	SSCSGHRGRING		224540		R48130	PC	0603-31	0	0		0	2	1	12	8	6	29.06	16 05 71
98232674001	1	Z	CICPSCOVERBRKT2		205880	PO	R55728	PC	0603-31	0	0		0	1	1	8	9	12	14.37	09 08 71
98232702801	1	Z	CASING CIA DNR	OB	036327		R54198	PC	0603-31	0	0		0	3	1	14	1	1	0.00	09 06 71 W.O.
98232706801	1	Z	CICASING		166204		R46994-1	PC	0603-31	0	0		0	2	1	14	1	3	144.09	16 05 71 W.O.
98232707801	2	Z	CASING CIA	OB	045298		R55133	PC	0603-31	0	0		0	3	1	14	1	1	0.00	09 06 71
98232709801	1	Z	CASING CIA	OB	036197		R44182-2	PC	0603-31	0	0		0	3	1	14	1	1	0.00	09 06 71 W.O.
98232805001	1	Z	CIHALFGLANDBRKT3		095899	PO	R55767	PC	0603-31	0	0		0	2	1	14	8	10	13.30	08 07 71 W.O.
98232805004	1	Z	CF12MHALFGLANDBRKT3		145898	PO	R55767	PC	0603-31	0	0		0	2	1	20	14	10	33.61	08 07 71 W.O.
98232809004	1	Z	CIFRAMESUPPORTBRKT2		005894	PO		PC	0603-31	0	0		0	3	1	12	1	1	1.33	16 05 71 W.O.
98232857009	1	P	PLASTICSHIM BRKT3			PO		PC	0603-32	0	0		0	1	1	8	37	250	0.18	16 05 71
98232857010	1	P	PLASTICSHIM BRKT3			PO		PC	0603-32	0	0		0	1	1	8	37	250	0.27	16 05 71
98232857011	1	P	PLASTICSHIM BRKT3			PO		PC	0603-32	0	0		0	1	1	8	12	250	0.49	16 05 71
98232857801	1	P	PLASTICSHIM BRKT1			PO		PC	0603-32	0	0		0	1	1	8	15	50	3.21	16 05 71
98232857802	1	P	PLASTICSHIM BRKT2			PO		PC	0603-32	0	0		0	1	1	8	11	300	3.23	16 05 71
98232877801	1	Z	CIBRGCOVER BRKT3		095947	PO	R55740	PC	0603-31	0	0		0	1	1	14	14	10	24.93	08 07 71
98232878002	1	Z	BRCASINGRING DNR		063024		R47067	PC	0603-31	0	0		0	3	1	14	1	1	0.00	16 05 71 W.O.
98232890801	1	Z	CICASING12X10X17		085908	PO	R55723	PC	0603-31	0	0		0	1	1	9	0	2	280.10	16 05 71
98232890806	1	Z	CF12MCSG12X10X17		225909	PO	R56719	PC	0603-31	0	0		0	1	1	9	4	3	1551.31	08 07 71
98232890807	1	Z	CGBCASING12X10X17DNR		076401	PO	R56719	PC	0603-31	0	0		0	2	1	9	1	1	0.00	16 05 71 W.O.
98232890809	1	Z	NICASING12X10X17DNR		026729	PO	R55723	PC	0603-31	0	0		0	3	1	9	1	1	294.00	16 05 71
98232890810	1	Z	CG3CASING12X10X17DNR		036807	PO	R56719	PC	0603-31	0	0		0	2	1	9	1	1	0.00	16 05 71
98232891801	1	Z	CICASING8X5X17		095902	PO	R55719	PC	0603-31	0	0		0	1	1	9	0	2	164.34	04 08 71
98232891806	1	Z	CF12MCSG8X5X17		145904	PO	R56716	PC	0603-31	0	0		0	1	1	9	0	2	680.99	08 07 71 W.O.
98232892801	1	Z	CICASING8X6X17		125905	PO	R55724	PC	0603-31	0	0		0	1	1	9	0	2	181.30	08 07 71 W.O.

FIGURE I-1

DESCRIPTION — a brief description of each part. Also, in the right hand area of the description field:

- SS - indicates special stock
- DNR - indicates a do not reorder item
- OB - indicates an obsolete item

SER. NO. — gives the issue and the serial number of the last shop order issued.

SIZE — 2 digit "where used" code to specify the size of the machine the part is used on (e.g. 22: 2 X 2 SRL pump).

PATTERN NO. — pattern number is listed for all items having a pattern.

U/M — specifies the unit of measure in which the part is physically used (e.g. each, set, piece).

LEDGER A/C — ledger account number.

COM. CL. — a commodity class code to facilitate special product reports.

SRL Complete Pumps	1
SRL Rubber Parts	2
SRL Skeletons	3
PWO Bracket I	4
PWO Bracket II	5
PWO Bracket III	6

BUY CDE — this is a code reserved for future use, for the buyer's code number.

QA CDE — quality assurance code.

INV. CDE — this is the code which will break out the computer reports by department.

Pump Section	Code 1 & 2
Mining Section	Code 3
Compressor	Code 4
Electrical	Code 5 & 7
Bar Stock etc.	Code 9 & 10

USG CDE — this code is used to give an indication of the frequency of usage:

- usage in more than 5 of the last 12 months	Code 1
- usage in one to five of the last 12 months	Code 2
- no usage in the last 12 months	Code 3

SAF FAC — on all forecasted items a safety factor of one (1) is used to obtain an 84% service level and is used in the safety stock calculation performed by the forecast program. If a factor of two (2) were used, a 98% service level would be achieved, but double the safety stock would be required.

LD TM — lead time is the time taken in weeks from the date the order is issued by the computer until the parts are actually received in stock.

ORD PT — order point is calculated by the computer. It is the multiplication of the lead time in months times the forecasted monthly usage plus the safety stock.

EOQ — economic order quantity is the lot size called for when the computer issues an order to replenish inventory.

UNIT COST — the latest cost per unit as determined by the cost department.

ISS. DATE — represents the issue date of the last change to the parts file. Also listed are the initials of the person who made the change.

PARTS FILE LISTING SUB-SYSTEMS

I-1.1 Parts File Maintenance Error List

The purpose of this report is to list incorrectly keypunched cards.

Error card images are printed under a formated heading with asterisks printed above the fields in error.

An error message is also printed with the card image to give the reason for the error.

Possible error messages are:

"invalid card type"
"invalid fields"
"dependence failure"

A typical format is shown in Figure I-2.

ALLIS-CHALMERS CANADA LTD — PARTS FILE MAINTENANCE ERROR LIST — DATE 12/07/71 — PAGE 1

PART NUMBER | CC REASON FOR ERROR | CARD IMAGE AND ERROR FIELDS

1234567890123456789012345678901234567890123456789012345678901234567890

6 CARDS PROCESSED
6 RECORDS OUTPUT
0 FAILED

FIGURE I-2

I-1.2 Parts Update Error Report

Errors can occur when the parts master file is updated by the transaction cards. This report contains all these errors. For each error the transaction card is identified and printed with its part number and a reason for error message.

There are nine possible messages to be found on this report:

1. "THIS RECORD NOT ON MAIN FILE"
2. "THIS RECORD ALREADY ON MAIN FILE"
3. "THIS RECORD HAS ALREADY BEEN DELETED"
4. "NO HEADING RECORD SUBMITTED"
5. "THIS RECORD HAS BEEN DELETED"
6. "INCOMPLETE/CHANGED RECORD ON FILE"
7. "ALL DETAILS HAVE BEEN DELETED"
8. "CHANGES AFTER APPROVAL GIVEN"
9. "THIS RECORD HAS BEEN APPROVED"

A typical format is shown in Figure I-8.

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PART NUMBER	ERROR CD	TC	REASON FOR ERROR
123456789	02	A	THIS RECORD ALREADY ON MAIN FILE
123456789	02	A	THIS RECORD ALREADY ON MAIN FILE
123456789	02	A	THIS RECORD ALREADY ON MAIN FILE
1710129001	06		INCOMPLETE/CHANGED RECORD ON FILE
1713008001	03	D	THIS RECORD HAS ALREADY BEEN DELETED

FIGURE I-3

I-1.3 Update Parts Master File

This weekly report contains all the parts file updated by the transaction cards. It gives a list of all these parts after the update from the transaction cards.

All the information on these weekly reports is transferred to the complete Parts File Listing when it is requested.

A typical format is shown in Figure I-4.

ALLIS-CHALMERS CANADA LTD — PARTS FILE LISTING — DATE 12/04/71 — PAGE 1

PART NUMBER	CDE	TYP	DESCRIPTION	SER.NO	SIZE	PATTERN NO	ITEM LEDGER ACC	CUM CL	BUY CDE	QA CDE	INV CDE	USG CDL	SAF FAC	LD TM	ORD PT	EOQ	UNIT COST	ISS.DATE
12345h789	1	M	ROTOR BLADES	0057LL	G		SEE 0023-A	0	0		0	1	1	10	1	1	159.50	01 04 71 * FRLD

FIGURE I-4

I-2 INVENTORY STOCK STATUS

This is a complete listing in part number sequence of all the items stocked, as well as their present stock status.

Referring to Figure I-5, the report contains:

PART NUMBER	a drawing number describes each part.
DESCRIPTION	a brief description of each part.
TOTAL STOCK	the number of finished units in stock.
QTY. ON ORDER	the total number of units on order from the shop or a supplier.
QTY. ON B.O.	the quantity on back order represents the number of items allocated to customer and other shop orders that have not yet been taken from stores.
AVAIL. STOCK	available stock = (total stock) + (quantity on order) - (quantity on back order)
ORDER POINT	is calculated by the computer.
EOQ	economic order quantity.
LD TM	lead time in weeks.
US CD	usage code (1, 2, or 3).

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PART NUMBER	DESCRIPTION	TOTAL STOCK	QTY ON ORDER	QTY ON [illegible]	AVAIL STOCK	ORDER POINT	FOU-LD TM	US CD	MTL CE	UNIT COST	TOTAL COST	STOCK ADJS	YTD REC.
98-131-604-501	RUBBER BUSHING	45.00	0.00	0.00	45.00	113	200	12	1	P	1.65	[illegible]	0	143
98-131-604-502	RUBBER BUSHING	65.00	0.00	0.00	65.0	166	133	12	1	P	1.35	87.75	0	216
98-131-606-001	CHARGEPLATE DNR	2.00	6.00	0.00	8.00	1	5	14	2	2	[illegible]	[illegible]	4	4
98-131-607-001	BRG END PLATE CIA	10.00	0.00	0.00	10.00	5	10	12	2	2	9.24	92.40	0	0
98-131-608-001	BRG END PLATE CIADNR	6.00	0.00	0.00	6.00	2	1	12	2	2	7.46	44.76	0	0
98-131-609-001	BRG END PLATE CIADNR	2.00	0.00	0.00	2.00	3	1	12	2	2	10.63	21.26	0	0
98-131-624-001	BRG END PLATE CIA	6.00	0.00	1.00	5.00	3	5	12	1	2	13.61	68.05	0	2
98-131-625-001	BRG END PLATE CIA	8.00	0.00	1.00	7.00	3	10	12	1	2	6.97	55.76	0	3
98-131-626-001	BRG END PLATE CIA	5.00	0.00	1.00	4.00	1	6	12	2	2	7.24	36.20	0	2
98-131-639-001	BRG END PLATE CIA	4.00	0.00	1.00	3.00	2	6	12	2	2	7.81	31.24	0	0
98-131-640-001	BRG END PLATE CIA	5.00	0.00	1.00	4.00	4	5	12	2	2	5.43	27.15	0	0
98-131-641-001	BRG END PLATE CIA	3.00	0.00	1.00	2.00	1	4	12	2	2	7.86	23.58	0	3
98-131-642-001	BRG END PLATE CIA	5.00	4.00	1.00	8.00	4	4	12	2	2	7.92	39.60	0	0
98-131-647-001	CHARGENDPLATE	4.00	10.00	0.00	14.00	1	1	14	2	2	12.00	48.00	0	6
98-131-648-001	CHARGENDPLATE	4.00	10.00	0.00	14.00	1	10	14	2	2	10.55	42.20	0	6
98-131-650-001	CHARGENDPLATE	4.00	8.00	0.00	12.00	1	1	14	2	2	14.92	59.68	0	5
98-131-651-001	BRG END PLATE CIA	13.00	0.00	1.00	12.00	3	13	12	1	2	11.36	147.68	0	11
98-131-654-001	BRG END PLATE CIA	5.00	6.00	1.00	9.00	2	6	12	2	2	9.02	49.60	0	4
98-131-655-001	BRG END PLATE CIA	9.00	0.00	3.00	6.00	5	6	12	2	2	39.67	238.71	0	3
98-131-656-001	BRG END PLATE CIA	6.00	0.00	0.00	6.00	2	4	12	2	2	12.16	72.96	0	0
98-131-657-001	BRG END PLATE CIA	10.00	6.00	6.00	10.00	4	6	12	2	2	13.97	139.70	0	6
98-131-660-001	BRG END PLATE CIA	2.00	0.00	0.00	2.00	4	4	12	2	2	21.64	42.28	0	0
98-131-661-001	BRG END PLATE CIA DD	8.00	0.00	0.00	8.00	1	1	12	2	2	8.30	66.00	0	0
98-131-676-001	BRG END PLATE CIADNR	2.00	0.00	0.00	2.00	2	1	12	1	2	6.92	13.84	0	0
98-131-677-001	BRG END PLATE	9.00	0.00	0.00	9.00	6	4	12	3	2	14.45	130.05	0	0
98-131-693-001	BRG END PLATE	8.00	0.00	0.00	8.00	7	5	12	2	2	22.83	182.64	0	0
98-131-695-001	BRG END PLATE	9.00	0.00	0.00	9.00	2	4	12	2	2	5.70	53.80	1	1
98-131-704-001	BRG END PLATE	13.00	6.00	7.00	19.00	6	6	12	2	2	9.09	123.89	6	1

FIGURE I-5

MTL CL — M, P, or Z designates source of part (see "TYP" . Parts File).

UNIT COST — the latest cost per unit.

TOTAL COST — total value of inventory for each unit = (unit cost) X (total stock).

STOCK ADJS — any changes due to inventory lost or gained during a physical inventory is indicated here.

YTD. REC. — year to date receipts of items into stock from suppliers or shop orders.

INVENTORY STOCK STATUS SUB-SYSTEMS

I-2.1 Inventory File Maintenance Error List

The purpose of this report is to list incorrectly keypunched cards following the same format description as the Parts File Maintenance Error List.

A typical format is shown in Figure I-6.

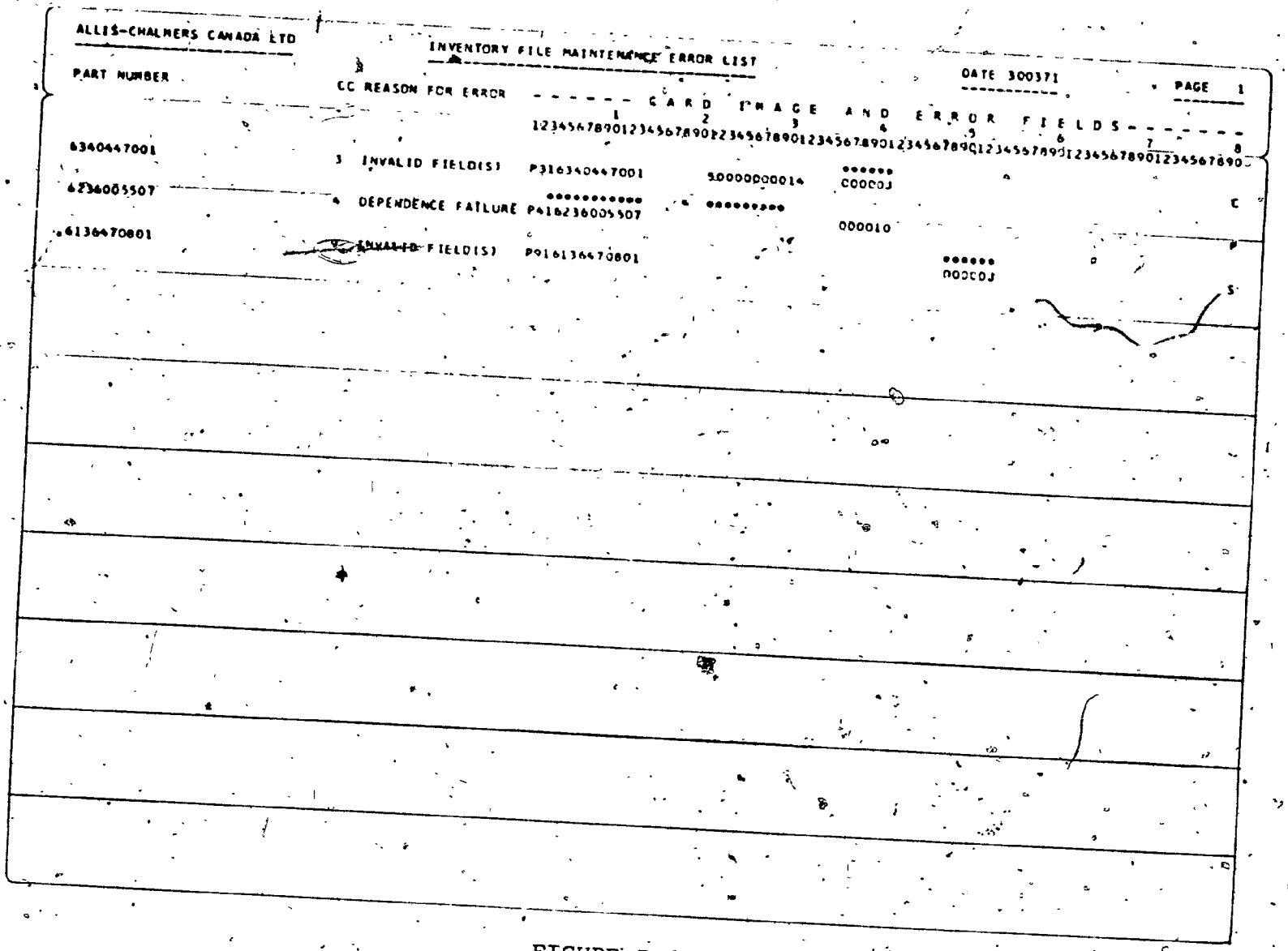
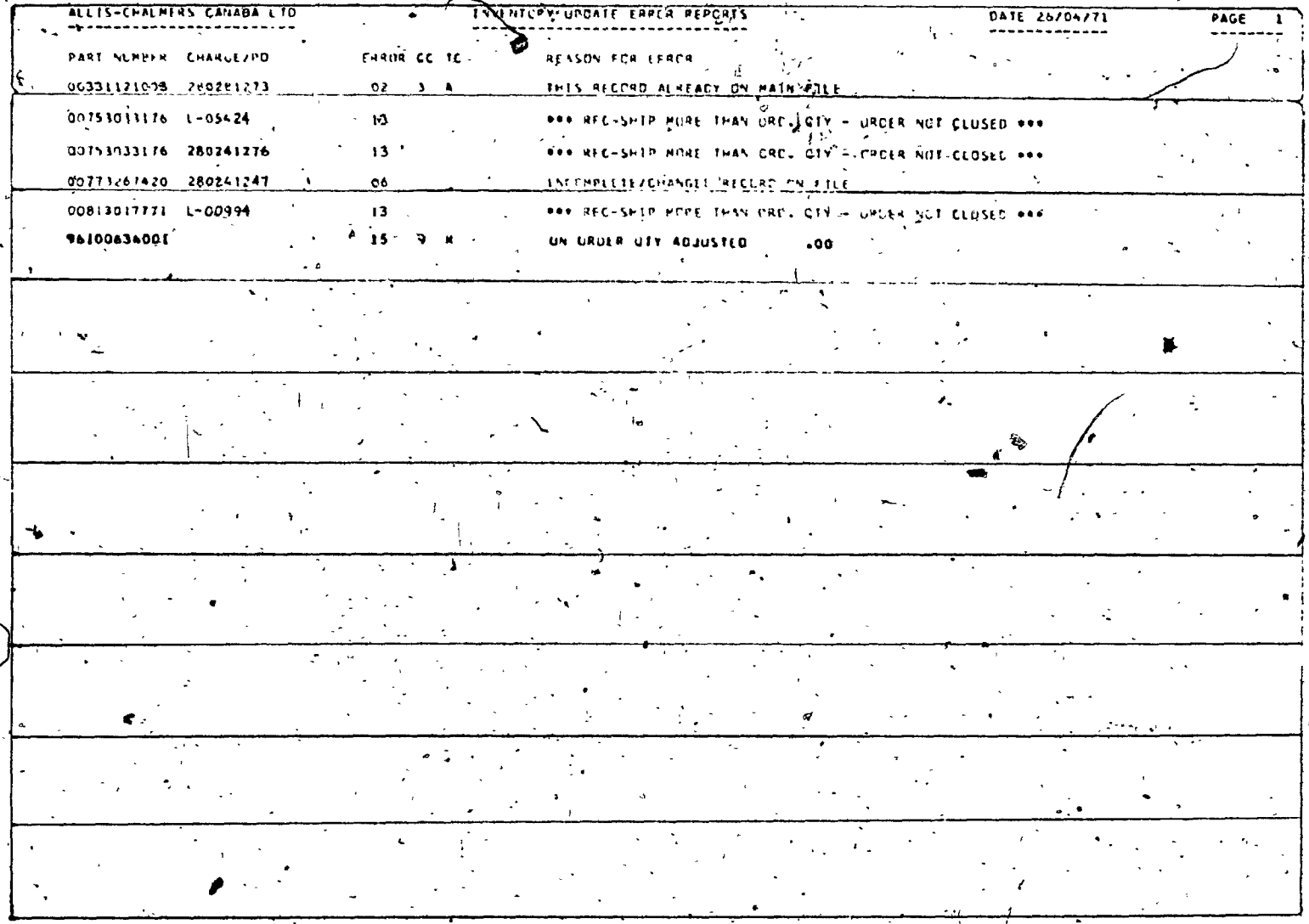

ALLIS-CHALMERS CANADA LTD
INVENTORY FILE MAINTENANCE ERROR LIST
DATE 300371
PAGE 1
PART NUMBER
CC REASON FOR ERROR
CARD IMAGE AND ERROR FIELDS
1234567890123456789012345678901234567890123456789012345678901234567890
6340447001
3 INVALID FIELD(S)
P31634044700150000000014 COOCOJ
6736005507
4 DEPENDENCE FAILURE
P41623600550700000010
6136470801
INVALID FIELD(S)
P91613647080100COCOJ

FIGURE I-6

I-2.2 Inventory Update Error Reports

This report lists all maintenance for which an informational or error message is printed.

A typical format is shown in Figure I-7.



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PART NUMBER	CHANGE/PO	ERROR CC	TC	REASON FOR ERROR
0033112103B	280241273	02	3 A	THIS RECORD ALREADY ON MAIN FILE
0075303311?6	L-05424	13		*** REC-SHIP MORE THAN ORD. QTY - ORDER NOT CLOSED ***
0075303311?6	280241276	13		*** REC-SHIP MORE THAN ORD. QTY - ORDER NOT CLOSED ***
0077?67420	280241247	06		INCOMPLETE/CHANGE RECORD ON FILE
00813017771	L-00994	13		*** REC-SHIP MORE THAN ORD. QTY - ORDER NOT CLOSED ***
9810083A00E		15	9 M	ON ORDER QTY ADJUSTED .00

FIGURE I-7

I-3 REQUISITION RUN

This report raises orders for items which have reached the order point after all the weekly transactions have been processed.

Referring to Figure I-8 the report contains:

PART NUMBER	a drawing number describes each part.
SIZE	the size of the machine the part is used on.
DESCRIPTION	a brief description of each part.
STOCK ORDER NUMBER	if the item is manufactured in the shop, the 3 series shop order number will be listed here.
ORDER QUANTITY	will be the same as the EOQ. If the EOQ is 10 and there are requirements for more than 10 units, then multiple shop orders will be issued for 10 each to cover the order point.
WEEK REQD.	based on the lead time of the item the computer will state the week in which the finished parts are expected to be placed in stock.
MATL. CLASS	refers to "TYP" on Parts File and could be M, P, or Z codes.
COMMOD CLASS	a commodity class code to facilitate special product reports.
QUALITY ASS. CODE	quality assurance code.
UNIT COST	the latest cost per unit.

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PART NUMBER	PUMP SIZE	DESCRIPTION	STOCK ORDER NUMBER	ORDER QUANTITY	WEEK REQD	MATL CLASS	COMMOD CLASS	QUALITY ASS CODE	UNIT COST	EXTENDED VALUE
16-136-450-513	9M	C I CYLINDER	3-1602-6711	1.00	32	Z	0		1540.00	1540.00
16-136-450-513	9M	C I CYLINDER	3-1603-6711	1.00	32	Z	0		1540.00	1540.00
16-136-450-513	9M	C I CYLINDER	3-1604-6711	1.00	32	Z	0		1540.00	1540.00
16-136-450-513	9M	C I CYLINDER	3-1605-6711	1.00	32	Z	0		1540.00	1540.00
16-136-450-513	9M	C I CYLINDER	3-1606-6711	1.00	32	Z	0		1540.00	1540.00
16-136-473-811	9M	ROTOR BLADES	3150[illegible]	4.00	32	P	0		200.00	800.00
16-340-447-001	9M	ROTOR SHAFT	3-1601-3441	2.00	32	Z	0		1325.00	2650.00
16-340-447-001	9M	ROTOR SHAFT	3-1602-3441	2.00	32	Z	0		1325.00	2650.00
16-340-447-001	9M	ROTOR SHAFT	3-1603-3441	2.00	32	Z	0		1325.00	2650.00
16-340-447-001	9M	ROTOR SHAFT	3-1604-3441	2.00	32	Z	0		1325.00	2650.00

FIGURE I-8

EXTENDED VALUE values of requisitioned item(s) = (unit cost) X (quantity ordered)

I-4 OPEN CUSTOMER/SHOP ORDERS

This report lists all open shop and customer orders.

Additionally, it contains all orders which have been completed during the month. At the end of each month, all closed orders are transferred to a monthly closed order report for reference purposes.

Referring to Figure I-9, the report contains:

PART NUMBER	a drawing number describes each part.
CHARGE/P.O. NUMBER	3 series shop order number, or 2, 4, 6, or 7 series customer allocation.
DESCRIPTION	a brief description of each part.
ORD. DATE	the date the order was initiated.
ORD. QTY.	the quantity ordered on the shop order or the allocation.
DUE	the date the order is requested for completion.
B.O. QTY.	the back order quantity. This has to do with allocation and is computer calculated.
RECEIPTS	the number of units received against the shop order to date.
ISSUES	the number of units issued against the allocation to date.

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PART NUMBER	CHARGE/P.O.NO.	DESCRIPTION	ORD DATE	ORD.QTY	DUE	B.O. QTY	RECEIPTS	ISSUES	CLSD	TOTAL BO COST
	6-9871-0088	ST-OIL-THROWER-ASSY	32	1.00	0	1.00		0.00		17.23
98-231-605-001	3-9809-6221	BRRSHAFTSLEEVE	34	6.00	50	6.00	0.00			47.94
98-231-636-804	3-9804-5203	SS DELETE ASAP	26	0.00	37	0.00	0.00		37	0.00
98-231-644-804	3-9813-6385	316SIDEPL	22	2.00	38	2.00	0.00			376.48
	3-9814-6385	316SIDEPL	22	2.00	38	2.00	0.00			376.48
	3-9815-6385	316SIDEPL	22	2.00	38	2.00	0.00			376.48
	4-9800-4575	316SIDEPL	18	1.00	28	1.00		0.00		188.24
	7-9829-2645	316SIDEPL	35	1.00	39	1.00		0.00		188.24
98-231-660-801	3-9815-5694	CL-SIDEPL	26	6.00	40	6.00	0.00			359.34
98-231-660-804	3-9832-5208	316SIDEPL	22	6.00	38	6.00	0.00			1378.98
98-231-664-804	3-9819-5206	316 WEAR PL 10X8PWF	32	4.00	48	4.00	0.00			761.36
	3-9820-5206	316 WEAR PL 10X8PWF	34	4.00	50	4.00	0.00			761.36
98-231-668-804	3-9817-5240	316SUCTSIDEPL	26	3.00	47	3.00	0.00			749.28
98-231-723-001	3-9826-6439	CIA-SHFT-SLV12X10 C	20	5.00	28	5.00		0.00		120.45
	3-9827-6439	CIA-SHFT-SLV12X10 C	35	3.00	39	3.00		0.00		72.27
	3-9836-6367	CIA-SHFT-SLV12X10 C	2	25.00	11	11.00	14.00			264.99
	3-9838-6367	CIA-SHFT-SLV12X10 C	21	5.00	38	5.00	0.00			120.45
	3-9839-6367	CIA-SHFT-SLV12X10 C	31	25.00	46	25.00	0.00			602.25
	3-9840-6367	CIA-SHFT-SLV12X10 C	31	25.00	46	25.00	0.00			602.25
	3-9841-6367	CIA-SHFT-SLV12X10 C	36	25.00	51	25.00	0.00			602.25
	4-9816-3011	CIA-SHFT-SLV12X10 C	2	5.00	11	5.00		1.00		120.45
	4-9816-3046	CIA-SHFT-SLV12X10 C	2	6.00	11	6.00		0.00		144.54
	4-9818-2762	CIA-SHFT-SLV12X10 C	2	1.00	11	1.00		0.00		24.09
	4-9818-2786	CIA-SHFT-SLV12X10 C	2	1.00	11	1.00		0.00		24.09
	4-9818-2791	CIA-SHFT-SLV12X10 C	2	1.00	11	1.00		0.00		24.09
	4-9818-3015	CIA-SHFT-SLV12X10 C	2	2.00	11	2.00		0.00		48.18
	4-9818-4223	CIA-SHFT-SLV12X10 C	11	2.00	16	2.00		0.00		48.18
	4-9818-4946	CIA-SHFT-SLV12X10 C	32	1.00	2	1.00		0.00		24.09

FIGURE 1-9

CLSD	the date the order was completed.
TOTAL B.O. COST	total back order cost = unit cost X B.O. quantity.

I-5 INVENTORY FORECAST REPORT

This report is issued monthly to cover all parts whose part code equals one and whose order point has been calculated by the computer based on demand in the current month.

The technique of exponential smoothing is used in the order point calculation for parts with non-zero usage in at least six of the last twelve months (usage code 1) and whose stability meets certain minimum requirements as determined by a Tracking Signal.

Order points for "borderline parts" changing from usage code 2 to 1 are calculated using averaging techniques due to their unstable behaviour.

Order points for usage code 2 and 3 parts are not changed by the computer.

A detailed explanation of this forecasting system follows:

Usage Code 1 - Parts with customer orders for at least six of the last twelve months.

Usage Code 2 - Parts with customer orders for at least one but less than six of the last twelve months.

Usage Code 3 - Parts with no customer orders for the past twelve months.

I-5.1 USAGE CODE ONE PARTS - "CODE UNCHANGED SINCE PREVIOUS RUN"

This group follows the core of the system. Their Usage Code has not changed since the previous calculation.

The consumption has been scanned by the program and it is determined that the particular part is still Usage Code One. The objective is to catch any abnormal behaviour in the system by measuring "The Tracking Signal". A parameter required to achieve this objective is the Current Deviation.

I-5.1.1 Current Deviation

Current Deviation = (Current Demand - Forecast Monthly Average)

Since at this stage of the program we are strictly concerned with an abnormality but not its direction (i.e. positive or negative), the Current Deviation is made positive and called the "Absolute Deviation".

Absolute Deviation = Current Deviation (made positive).

This figure is held aside in the computer memory and will be referred to at a later stage.

I-5.1.2 The New Running Deviation

Assuming that a good estimate of demand implies that actual orders will (on the average) be above the forecasted value for half the time and below the value half the time, a cumulation of monthly "Current Deviations" is maintained and should fluctuate randomly about zero if the system is behaving normally. This cumulation is called the "New Running Deviation".

New Running Deviation = (Running Deviation + Current Deviation)

I-5.1.3 The New Mean Average Deviation (M.A.D.)

We now calculate the second parameter required.

The Mean Average Deviation is a weighted moving average of the previous deviations and it is computed using a technique known as Exponentional Smoothing. This technique eliminates the need for keeping long historical records and thus reduces the Data Processing time required.

Therefore, applying the Exponential Smoothing formula with the most commonly used smoothing factor of .1, the program calculates:

New M.A.D. = Old M.A.D. + .1 (Absolute Deviation - Old M.A.D.)

I-5.1.4 The Tracking Signal (Track)

At this stage of the program the parameters required to calculate the Tracking Signal are now available. It is arrived at by dividing the New Running Deviation by the New Mean Average Deviation and making the result positive.

$$\text{Tracking Signal} = \frac{\text{New Running Deviation}}{\text{New M.A.D.}}$$

(made positive)

If the Tracking Signal is equal to or greater than 4, the system is not behaving normally. The program will calculate an average consumption by adding the current customer ordered quantities to the last two months consumption and dividing the result by 3. This average monthly consumption figure is stored in memory as the "New Forecast".

Article I-5.1.6, the New Forecast, is by-passed in the calculations.

If the Tracking Signal is less than 4, the system is behaving normally and the program proceeds further along the same path.

I-5.1.5 The Safety Stock

Although the Safety Stock is not accessible to an outside user, it is calculated in the program to be part of the Order Point formula, which in turn, is computed at a later stage.

$$\text{Safety Stock} = \text{New M.A.D.} \times 1.25 \times 1 \times \sqrt{\frac{\text{Lead Time} + 1}{4}}$$

This method of using a Safety Stock based on a measure of the forecast error (M.A.D.) permits the system to quantitatively determine the level of inventory to provide the service required.

The factor 1.25 is a correction factor to approximate the Normal Standard Deviation and should not be changed.

The factor 1 is the factor that affects the level of Safety Stock required. ie. In our application it has been decided (assuming normality of demand) that a customer order placed during a lead time will be fulfilled 84% of the time. This is a marketing decision. If we wish to provide a better service to customers (thus maintaining a higher inventory) the Safety Factor 1 could be changed to 2 to provide a 98% ratio of filled to unfilled customers' orders.

It is understood that the Safety Stock will vary in the same proportion as the Safety Factor.

The Lead Time in weeks is that interval between the placement of a Shop Order or Purchase Order and the receipt of the parts; it is based on experience and is entered onto the part file for each part. One week is added to the Lead Time to allow for paperwork processing time. The factor 4 is the time interval in weeks between reviews of the system.

I-5.1.6 The New Forecast

To determine "when to order" we require the New Forecasted Monthly average figure. Using the same technique as previously applied in computing the Mean Average Deviation we state:

New Forecasted Monthly Average = (Old Forecasted Monthly Average + .1 [Current Demand - Old Forecasted Monthly Average]).

The application of this exponential smoothing formula to obtain a New Forecast assumes that we can predict sales based on the historical movement of the considered parts.

I-5.1.7 The Order Point

With the Safety Stock and the New Forecast Monthly Average in the Computer memory, the program proceeds to calculate the Order Point.

Order Point =

$$(\text{NEW FORECASTED MONTHLY AVG.}) \times \left(\frac{\text{LEAD TIME} + 1}{4}\right) + \text{SAFETY STOCK}$$

The Order Point for a part is the level of available inventory at which an order for replenishment should be placed.

I-5.1.8 The final computation is an indicator of the actual service level provided to customers.

$$\text{ACTUAL SERVICE LEVEL} = \frac{\text{YEAR TO DATE SHIPMENT QUANTITY}}{\text{YEAR TO DATE DEMAND QUANTITY}} \times 100\%$$

It is clear that the actual service level is not necessarily the same as the planned service level to customers provided through an adjustment in Safety Stock.

The actual service level is a measure of what happens in terms of service to customers, whereas the Safety Stock value is a tool to increase or decrease that service.

The actual service level is always computed regardless of the calculation path followed by the system.

I-5.2 USAGE CODE ONE PARTS - "CODE CHANGED FROM 2 TO 1"

If the consumption indicates that orders against a part have been entered at least once but in less than six of the last 12 months, this part is a Usage Code 2 item. A sixth positive entry in the consumption card changes the Usage Code of the part from 2 to 1.

I-5.2.1 The Average Consumption or New Forecast

When the current calculation revises a part from Code 2 to 1, this "borderline case" does not justify the application of exponential smoothing as a forecasting technique. The new Forecasted average is calculated by taking a 12 months average consumption.

$$\text{Average Consumption} = \frac{\text{Sum of the last 12 months consumption}}{12}$$

New Forecasted Average = Average Consumption

It is understood that in applying the above formula the new forecast figure will tend to be underestimated at least 6 of the next 12 months. This underestimation is accounted for in paragraph I-5.2.2

I-5.2.2 The New Mean Average Deviation

Since the forecast is based on a monthly average consumption, it is statistically justifiable that its deviation be based on the same rules, i.e. the new M.A.D. is a 12 months average deviation from forecast.

Monthly Deviation = (Monthly Consumption - Forecast) made positive

Result = Sum of Monthly Deviations

New Mean Average Deviation = $\frac{\text{Result}}{12}$

Once the New Forecast and the Mean Average Deviation are computed the calculations are carried out as described in paragraphs I-5.1.5 to I-5.1.8 - paragraph I-5.1.6 is by-passed.

I-5.3 USAGE CODE TWO PARTS - "CODE IS CHANGED FROM 1 TO 2"

This paragraph covers the manual operations required should the Usage Code of a part be changed from 1 to 2.

A change in Usage Code from 1 to 2 implies a decrease in yearly consumption which in turn could necessitate (optional) a revision in ordering strategy.

In this case, the Order Point would have to be revised manually or it will stay at the level last calculated when the part was in Usage Code 1. Meanwhile, the current run proceeds to calculate the Service Percent as described in I-5.1.8 above.

I-5.3.1 Usage Code Two Parts - "Two More Possibilities"

In scanning the consumption for a Usage Code 2 part there are two other possibilities to be covered. Either the Code is unchanged or consumption is picking up and the Code has changed from a 3 to a 2 classification.

I-5.3.2 Usage Code Two Parts - "No Change in Usage Code"

The computer listing shows against a particular part number the statement "No demand in 6 of the last 12 months". The program will then proceed as described in I-5.1.8.

If desired, the Order Point has to be changed manually.

I-5.3.3 Usage Code Two Parts - "Usage Code Changed from 3 to 2"

The consumption records monthly customer orders. It is possible that a part which has not been ordered for at least 12 months is ordered in the current period - this would change the status of the part from 3 to 2.

Management could feel a change in ordering strategy is required (see paragraph I-5.3). Meanwhile, the program will proceed to paragraph I-5.1.8.

I-5.4 USAGE CODE THREE PARTS

When the consumption of a part for the past 12 months is zero, the part will have a Usage Code equal to 3.

If in a current run a Usage Code is changed from 2 to 3, Management could decide to review the Ordering Strategy (see paragraph I-5.3). The listing will show against the Usage Code 3 part the statement "No Demand in Last 12 Months".

(If the part already had a Usage Code 3 and no further consumption is recorded in the current run there should not be a revision in the Ordering Strategy - it is assumed that this strategy was originally revised when the Usage Code changed from 2 to 3.)

The results of the inventory forecast program are printed on the inventory forecast report as shown in Figure I-10.

Data presented:

PART NUMBER	a drawing number describes each part.
SIZE	2 digit "where used" code to identify the size of the machine the part is used on.
DESCRIPTION	a brief description of each part.
QTY. IN STOCK	the total number of finished units in stock.
QTY. ON ORDER	the total number of units on order.
CURRENT DEMAND	the total number of units ordered in the current period.
YTD SHIP	the total number of units shipped during the last 12 months.
S/L PER	the service level percent = $\frac{(\text{year to date shipment quantity})}{(\text{year to date demand quantity})} \times 100\%$
ORDER POINT	the current order point.
EOQ	the economic order quantity.
LT	the lead time in weeks.

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PART NUMBER	SIZE	DESCRIPTION	QTY IN STOCK	QTY ON ORDER	CURRENT DEMAND	Y-T-D SHIP	S/L PER	ORDER POINT	EOQ	LT	D M USG	MAD	FOR	SF	TRACK	RUN DEV	DOLLAR VOLUME
16136450513	9M	C I CYLINDER	0	7	4	0	0	1	1	18	2 2 NO	DEM	IN	6	OF LST	12 MOS	0.00
16136456802	7D	ROTOR BLADES	7	6	1	15	83	6	6	18	1 1 0.7	1	1		0.0	0.0	1317.60
16136457802	8A	LP ROTOR BLADES	10	15	2	60	57	1	15	18	1 1 0.4	0	1		0.0	0.0	2720.00
16136458802	0G	ROTOR BLADES	21	0	1	66	20	14	20	1M	1 1 1.5	2	1		0.0	0.0	4263.80
16136468801	E8	ROTOR BLADES	2	0	0	0	0	1	5	18	2 2 NO	DEM	IN	6	OF LST	12 MOS	0.00
16136469801	10	ROTOR BLADES	3	16	0	6	27	4	6	18	2 2 NO	DEM	IN	6	OF LST	12 MOS	113.68
16136470801	11	ROTOR BLADES	3	0	0	0	0	1	6	18	2 2 NO	DEM	IN	6	OF LST	12 MOS	0.00
16136471801	12	ROTOR BLADES	3	0	0	0	0	2	3	18	2 2 NO	DEM	IN	6	OF LST	12 MOS	0.00
16136472801	17	ROTOR BLADES	5	0	0	0	0	1	4	16	2 2 NO	DEM	IN	6	OF LST	12 MOS	0.00
16136473801	19	ROTOR BLADES	2	4	0	0	0	1	4	16	2 2 NO	DEM	IN	6	OF LST	12 MOS	0.00
16136473811	9M	ROTOR BLADES	0	8	2	0	0	1	4	16	2 2 NO	DEM	IN	6	OF LST	12 MOS	0.00
16236005502	5C	KP SEAL ASSY	10	10	0	0	0	5	10	16	2 2 NO	DEM	IN	6	OF LST	12 MOS	0.00
16236005505	8A	KP SEAL ASSY	11	0	0	10	43	6	16	20	2 2 NO	DEM	IN	6	OF LST	12 MOS	763.30
16236005506	1L	KP SEAL ASSY	12	0	0	20	0	4	10	8	2 2 NO	DEM	IN	6	OF LST	12 MOS	2700.00
16236005507	7S	KP SEAL ASSY	1	24	0	9	82	5	12	32	2 2 NO	DEM	IN	6	OF LST	12 MOS	926.19
16236005508	06	KP SEAL ASSY	7	15	0	16	73	5	16	32	2 2 NO	DEM	IN	6	OF LST	12 MOS	1672.92
16340447001	9M	ROTOR SHAFT	3-	10	4	3	0	1	2	1P	2 2 NO	DEM	IN	6	OF LST	12 MOS	3975.00
																***	18417.69

FIGURE I-10

O USG	the previous (old) usage code.
N USG	the current (new) usage code.
MAD	the mean average deviation.
FOR	the new forecasted monthly usage.
SF	the safety factor.
TRACK	the tracking signal.
RUN DEV	the running deviation.
DOLLAR VALUE	the dollar value of year to date shipments = (YTD SHIP X UNIT COST).

I-6 WEAKNESSES IN THE ORIGINAL SYSTEM

I-6.1 Parts File Listing

Basically this report required very few improvements.

I-6.1.1 The buyer code was originally set up so that the inventory analyst would know which buyer in Purchasing was responsible for procuring a particular part. We have found this to be of little value.

I-6.1.2 Keeping track of the serial number issue was a problem. In Figure I-1, Page (4), line 1, the serial number 075282 breaks down as follows:

"5282" is a constant representing the shop order to build part number 98-232-667-006.

"07" is the variable issue number assigned to distinguish between successive shop orders for the same part. In this case "07" would be the issue number for the last shop order entered.

The problem occurred because the requisition run issued orders each week for all parts whose availability reached the order point. Thus, in the case of a shop order, the computer issued a new order and added it to the open order file and stock status. Similarly, it advanced the issue number on the parts file to correspond to the last order entered.

Since the computer generated orders were being rejected frequently by Management during the early stages, it was necessary in each case to cancel the orders and reset the issue number on the Parts File. Failure to do this resulted in erroneous issue numbers being generated on future requisition runs.

I-6.2 Inventory Stock Status

Many changes were needed to improve this report.

I-6.2.1 Some fields were of doubtful value for this report:

e.g. MTL CL - This already appeared on the Parts File as "TYP".

YTD REC - Year to date receipts should have been covered by a complete closed order report.

TOTAL COST - This information was rarely needed in conjunction with this report.

I-6.2.2 Fields which should have been present were:

LEDGER ACCOUNT - This information has to be entered on all "issue" documents for accounting purposes.

USAGE & FORECAST DATA - This information would have assisted Management who must approve each order issued by the computer.

I-6.2.3 The stock status had to be used in conjunction with the open order file to handle daily activity. Often discrepancies occurred between the two reports which went unnoticed. A combined stock status/open order file would have been far superior since one report replaced two.

I-6.2.4 When the computer system was first installed the inventory analysts received the requistion run each week which specified which items should be ordered.

It was then necessary to complete the shop order approval card as shown in Figure I-11. The product manager was responsible for approval of each order before the part could be released for procurement.

Since it was assumed that the requisition run and the order point forecast system were functioning correctly 90% or more of the time, Management was not concerned over the lack of approval data on the shop order approval card.

When Accounting reported that inventory levels were rising quickly an investigation soon revealed that orders should not be approved without adequate approval data until it could be demonstrated that orders being generated were actually justified.

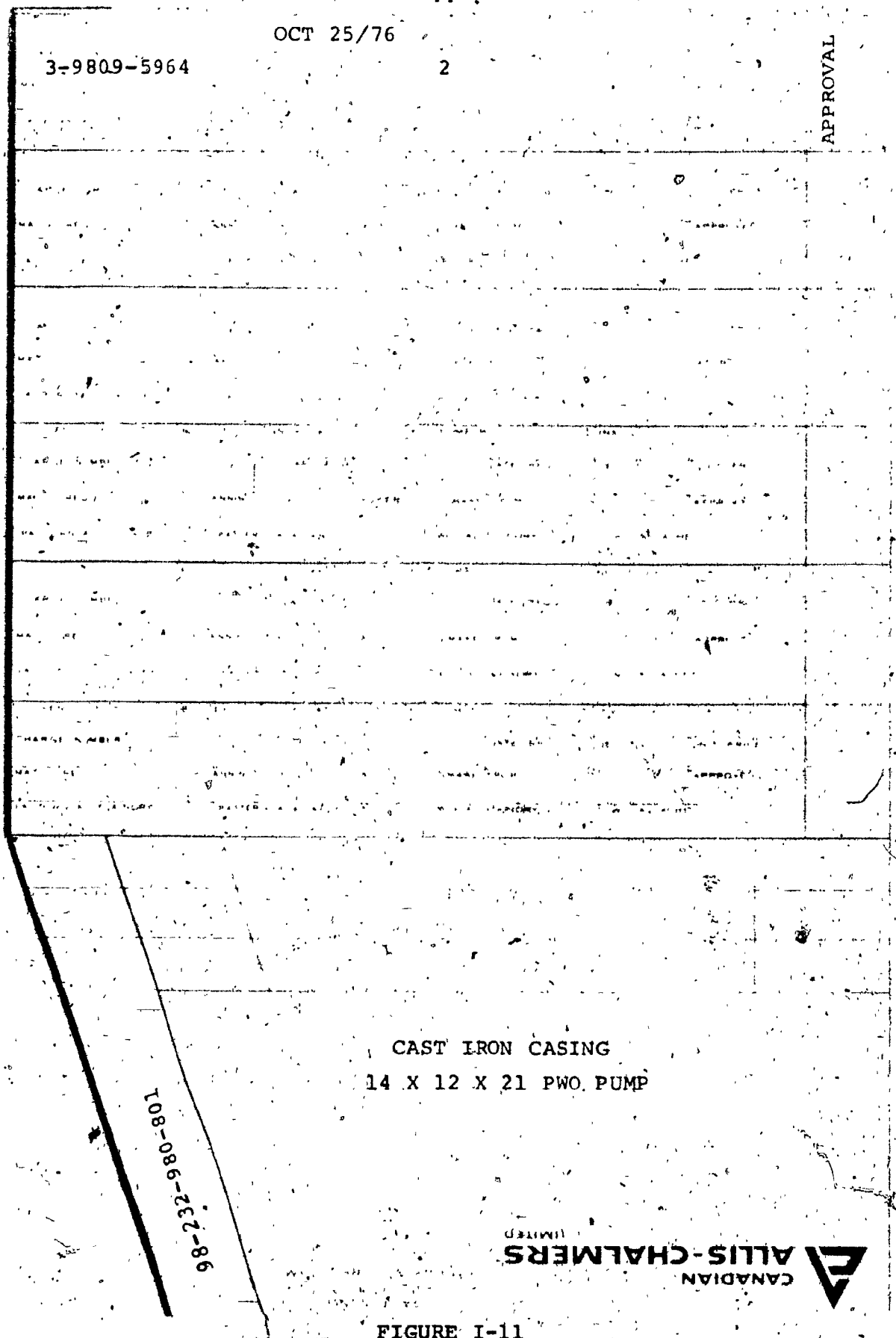
OCT 25/76
3-9809-5964
2
APPROVAL
CAST IRON CASING
14 X 12 X 21 PWO. PUMP
98-232-980-801
CANADIAN ALLIS-CHALMERS LIMITED

FIGURE I-11

I-6.2.5 The stock status contained approximately 3000 parts which covered 5 products. Originally, each inventory analyst received the entire stock status even though he was only concerned with his own product. Having a segregated report would have reduced paper cost, and time spent searching through the file.

I-6.3 Requisition Run

As described under the Parts File above, the major weakness was issuing orders and adding them to the stock status and open order file before they were approved. If ignored accidently, the requisition run did not keep printing orders which were not approved and it was possible to have an order on file which did not exist.

When the system was set up it was assumed that the computer would be correct in issuing orders 90% or more of the time so that time could be saved by automatically entering them until approved.

A solution would be to flag new orders entered on file which are not approved or to flag each part for which an order should be issued.

I-6.4. Open Customer/Shop Orders

The major weakness of this report is that it should have been combined with the stock status into one report.

However, the following additional points should also be corrected:

I-6.4.1 Open purchase orders were not listed for purchased finished parts.

I-6.4.2 Order entry and due dates for shop orders and customer orders and updating this information was not available originally.

I-6.4.3 Expand the order entry and due date from two digits to three digits to include the year and week number. The reason for this change is that some deliveries took 80 weeks and more.

I-6.4.4 Every fourth week, closed orders were dropped from the open order file leaving no readily accessible information to answer questions about closed orders or what was shipped. Additionally, a closed order report was issued each month representing the orders dropped from the open order file. When an attempt was made to check receipts and issues for a part going back several months, several reports had to be consulted which made reconciliation very difficult.

I-6.5 Inventory Forecast

This report required complete revision to become a useful program to regulate order points.

There were about 3000 parts on file of which 70% were classed as "part code 1" and were manipulated by the inventory forecast program.

Unfortunately, as described previously, the exponential smoothing technique only applied to "usage code 1" parts (i.e. customer orders for at least six of the last twelve months).

On analysis of the "part code 1" parts we found only 20% actually qualified as "usage code 1". Therefore, the remainder was handled by averaging techniques or was changed manually. This was not acceptable and, therefore, a more sophisticated program had to be developed.

I-6.6 Economic Order Quantity (EOQ)

The original system did not have a scientifically calculated EOQ because the demand rate in units per period could not be accurately estimated and the set up cost per set up was not known.

Once an accurate usage report is developed the demand rate can be estimated and the EOQ can be calculated.

I-6.7 Missing Analysis Reports

When the system was first introduced it was recognized that a Usage Report should be developed as soon as possible in order to generate analysis such as the ABC Report.

In addition, usage information could be used as a basis to identify surplus and obsolete inventory.

Also, every year a physical inventory was taken using a completely manual system. It was recognized that the inventory system had the potential to handle this function with ease.

II - CURRENT SYSTEM REPORTS

The following reports comprise the complete inventory system in use today:

	DESCRIPTION	ISSUED
II-1	PARTS FILE LISTING	Monthly
II-2	INVENTORY STOCK STATUS WITH ORDER PEGGING	Weekly
II-3	INVENTORY FORECAST - ITEMS WITH NEW ORDER POINT	Monthly
II-4	YEAR TO DATE CLOSED CUSTOMER/SHOP ORDERS	Monthly
II-5	CALCULATED ECONOMIC ORDER QUANTITY	On Request
II-6	USAGE	Monthly
II-7	PHYSICAL INVENTORY AUDIT	Annually
II-8	ANALYSIS REPORTS	
II-8.1	ABC Inventory Analysis	Quarterly
II-8.2	Surplus Stock Analysis	Quarterly
II-8.3	Obsolete Stock Analysis	Quarterly
II-8.4	Lacking Unit Costs	Quarterly
II-8.5	Critical Parts Report	On Request
II-8.6	Inventory Summary for Assembly of Pumps	On Request

Appendix C describes the Current System Reports in Block Diagram format.

A discussion of these reports follows highlighting the major improvements as well as a detailed description of the new reports.

II-1 PARTS FILE LISTING

Referring to Figure II-1, some enhancements have been made to improve the parts file:

II-1.1 The "ABC" code has been inserted in place of the "buyer" code.

II-1.2 A "CI" error message code was added to the Parts File to indicate an asterisk (*) whenever a part file is incomplete.

In Figure II-1, the asterisk (*) opposite part number 98-530-116-001 indicates that a make item "M" must have a serial number which is blank.

This technique has proven useful to ensure that the messages on the error reports are not forgotten since the asterisk will only disappear after the correction is made.

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PART NUMBER	PART GD	TY	----DESCRIPTION-----	SER-NO	SZ	-PATTERN-- NUMBER	REV NO	U/M	LEDGER ACCT	CM CL	ABC CD	QA CD	INV CDE	US CD	SF FC	LD TM	-ORDER- POINT	ECON-OR QUAN	--UNIT-- COST	ISSUE DATE	C I
9549500151	4	M	STBASEPLATE	016905	EA		000	EA	060331	0	R		1	3	1	12	1-	1	546.61	190476 L.B.	
9849500250	1	M	STBASEPLATE	016906	EA		000	EA	060331	0	B		1	2	1	12	1-	1	595.58	040175 L.B.	
9849500750	4	M	STBASEPL DRIP LIP	016998			000	EA	060331	0	R		1	2	1	12	1-	2	0.00	270976 L.B.	
9849501150	4	M	ST BASEPL DRIP LIP	016991			000	EA	060331	0	R		1	2	1	12	1-	3	1190.91	301176 L.B.	
9849501250	4	M	ST BASEPL DRIP LIP	016992			000	EA	060331	0	R		1	2	1	8	1-	2	1077.37	301176 L.B.	
9849501350	4	M	ST BASEPLATE DRIPLIP	016993			000	EA	060331	0	R		1	2	1	12	1-	2	898.28	171276 L.B.	
9849501450	4	M	ST BASEPLATE DRIPLIP	016994			000	EA	060331	0	R		1	2	1	12	1-	2	1007.74	171276 L.B.	
9853012050	4	M	GLAND-HALF-CAS 2X2	026817	22			EA	060391	0	B	6D	2	2	1	16	2	6	146.20	221176 L.B.	
9853010850	4	M	CIFRAME	155038		R52801		PC	060331	0	B		1	2	1	16	0	6	398.82	221176 L.B.	
9853011600	2	M	CIIMP 10X8PWG860008	160000		R52836		PC	060331	0	R		1	3	1	16	10-	1	0.00	221176 L.B.	
9853011600	2	M	CI IMP 10X8PWG 08	[redacted]		R52836		PC	067198	0	R		1	3	1	14	10-	1	600.00	221176 L.B.	
9853013100	1	M	CI IMPELLER 10X8SJD	326461		R53173		PC	060331	0	A		1	2	1	16	7	5	509.66	170177 L.B.	
9853013450	1	P	14X12 RUN-NAT		27			EA	060395	0	A		2	1	1	8	27	15	545.97	131076 L.B.	
9853013450	4	P	SPECIAL NAT BL14X12				000	EA	060395	0	B		2	2	1	10	0	5	545.97	190876 L.B.	
9853013450	6	P	14X12 RUN-CHEMICUM				000	EA	060395	0	C		2	2	1	14	1-	5	567.14	181075 L.B.	
9853013550	1	P	14X12 GLAND-LIN- NAT		27			EA	060395	0	A		2	1	1	8	15	10	525.30	131076 L.B.	
9853013550	4	P	GLAND LIN BLACK14X12				000	EA	060395	0	C		2	2	1	8	1-	5	525.30	140676 L.B.	
9853013550	6	P	14X12 GLAND-LIN-CHEM				000	EA	060395	0	B		2	2	1	14	1-	5	552.62	131076 L.B.	
9853013650	1	M	14X12 GLAND-LIN-SKEL	424918	27			EA	060397	0	A		2	1	1	14	18	8	227.09	091276 L.B.	
9853013850	1	P	14X12 SUCT-LIN NAT		27			EA	060395	0	A		2	1	1	8	21	10	475.30	131076 L.B.	
9853013850	4	P	SUC LIN BLACK 14X12				000	EA	060395	0	C		2	2	1	8	1-	5	475.30	140676 L.B.	
9853013850	6	P	14X12 SUCT-LIN CHEM				000	EA	060395	0	B		2	2	1	14	1-	5	505.10	131076 L.B.	
9853013950	1	M	14X12 SUCT-LIN SKEL	494916	27			EA	060397	0	A		2	1	1	14	18	11	154.71	170177 L.B.	
9853014350	4	M	SUCT-HALF-CAS 14X12C	364921	27			EA	060391	0	A	6D	2	2	1	16	2	2	1356.10	221176 L.B.	
9853014450	4	M	GLAND-HALF-CAS 14X12C	186818	27			EA	060391	0	A	6D	2	2	1	16	1	2	1816.86	251176 L.B.	
9853014550	4	M	FRAME-ASSY 14X12C	284922	27			EA	060391	0	A	6D	2	2	1	16	0	1	1503.56	221176 L.B.	
9853060501	2	M	GLAN-CAS 6X6V OP	C65647	19			EA	067198	0	R	6D	2	3	1	17	10-	8	257.00	221176 L.B.	

FIGURE II-1

ALLIS-CHALMERS CANADA LIMITED

II-2 INVENTORY STOCK STATUS WITH ORDER PEGGING

This report features many enhancements which were lacking in the original system.

In particular both open and recently closed orders are pegged for each part.

Referring to Figure II-2, the changes made are as follows:

ALLIS-CHALMERS CANADA LTD ICO5RW01 INVENTORY STOCK STATUS - 01 DATE 01/21/77 PAGE 79

--PART-NUMBER--	----DESCRIPTION-----	TOTAL STOCK	QTY ON-ORD	QTY ALLOC	AVAILABLE STOCK	SAFTY STOCK	ORDER POINT	EOQ	LD TM	TOTAL USAGE	FORECAST QTY	CD	UNIT-COST	LEDGER ACCOUNT	STK ADJ	ORD IND
98-232-964-802	BR CSG 8X6X21PWO 08	1.00			1.00	7	10-	1	18	0	.0	2	480.88	0671-98	C	
98-232-964-806	CF12MCSG8X6X21	2.00			2.00	7	1	2	30	1	.0	4	2117.26	0603-31	0	
98-232-965-801	CICASING10X8X21	2.00	2		4.00	7	1	2	16	3	.0	4	481.44	0603-31	0	
-ORDER-NO--	ENT CN/CR DUE BCK/OR RECVD CLSD				-ORDER-NO--	ENT	CN/CR	DUE	BCK/OR	SHPD	CLSD	-REF-ORDER-				
3-9827-5957	23 2 29 2 0 00															
98-232-965-806	CF12MCSG10X8X21	2.00			2.00	7	1	2	24	1	.0	4	2412.66	0603-31	0	
98-232-980-801	CICASING14X12X21	1.00	2	1	2.00	7	1	2	16	4	.0	4	875.24	0603-31	0	
-ORDER-NO--	ENT CN/CR DUE BCK/OR RECVD CLSD				-ORDER-NO--	ENT	CN/CR	DUE	BCK/OR	SHPD	CLSD	-REF-ORDER-				
3-9809-5964	43 2 20 2 0 00				2-9827-2016	51	1		1	0	00					
98-232-980-806	CF12MCSG14X12X21	3.00		2	1.00	7	0	2	24	1	.0	4	2929.65	0603-31	0	
-ORDER-NO--	ENT CN/CR DUE BCK/OR RECVD CLSD				-ORDER-NO--	ENT	CN/CR	DUE	BCK/OR	SHPD	CLSD	-REF-ORDER-				
					2-9827-1333	22	1		1	0	00	3-9817-5966				
					2-9827-1340	22	1		1	0	00	3-9817-5966				
					4-9800-8799	2	1		0	1	02					
98-232-980-810	CGSM CASING 14X12X21	.00			.00	7	1-	3	24	6	.0	4	.00	0603-31	C	
-ORDER-NO--	ENT CN/CR DUE BCK/OR RECVD CLSD				-ORDER-NO--	ENT	CN/CR	DUE	BCK/OR	SHPD	CLSD	-REF-ORDER-				
3-9801-6959	12 3 16 0 3 02				2-9827-1646	21	1		0	1	02					
3-9802-6959	20 3 18 0 3 03				2-9827-1648	21	1		0	1	02					
					2-9827-1771	21	1		0	1	02					
					2-9827-1772	21	1		0	1	03					
					2-9827-1773	21	1		0	1	03					
					2-9827-1774	21	1		0	1	03					
98-232-982-801	CI CSG16X14X21PWO	1.00			1.00	7	0	2	16	1	.0	4	932.02	0603-31	0	
98-232-982-806	CF12MCSG16X14X21	.00	2	1	1.00	7	0	2	24	4	.0	4	3404.00	0603-31	0	
-ORDER-NO--	ENT CN/CR DUE BCK/OR RECVD CLSD				-ORDER-NO--	ENT	CN/CR	DUE	BCK/OR	SHPD	CLSD	-REF-ORDER-				
3-9811-5963	43 2 17 2 0 00				1-9828-2635	45	2		1	1	00	3-9810-5963				
98-232-982-807	CGMCSG 16X14X21PWO	.00			.00	7	1-	1	33	0	.0	4	3586.45	0603-31	0	
98-232-982-810	CGSM CSG 16X14X21ONR	.00			.00	7	2-	2	24	0	.0	2	.00	0603-31	C	
98-233-017-001	BR SLV BRT3 PWO 08	1.00			1.00	7	10-	1	10	0	.0	2	60.05	0671-98	0	
98-233-017-003	CF12MSLEEVEBRKT3	10.00	14	4	20.00	1	18	15	24	30	2.0	1	91.09	0603-31	0	
-ORDER-NO--	ENT CN/CR DUE BCK/OR RECVD CLSD				-ORDER-NO--	ENT	CN/CR	DUE	BCK/OR	SHPD	CLSD	-REF-ORDER-				
3-9930-5990	35 14 13 14 0 00				2-9827-1846	28	2		0	2	50					
					2-9827-1861	34	1		0	1	32					
					2-9827-1878	38	1		1	0	00	3-9829-5990				
					2-9827-2016	51	1		1	0	00					
					4-9828-8752	51	1		0	1	01					
					4-9828-8838	3	1		0	1	03					

FIGURE II-2

ALLIS-CHALMERS CANADA LIMITED

II-2.1 Combined Report

The combination of the old Inventory Stock Status (Figure I-5) with the previous Customer/Shop Orders Report (Figure I-6) is considered one of the significant improvements to the system. It offers the following advantages:

(i) one less report

(ii) the previous reports had to be used together

(iii) error reconcilliation much simpler

(iv) increased efficiency/reduced possibility of error

Examining each of the original reports, the following enhancements were made:

II-2.2 Inventory Stock Status

II-2.2.1 The sample shown in Figure II-2 indicates the heading "Inventory Stock Status - 01" which means only "inventory code 1" parts are listed.

II-2.2.2 Print Format

The program was modified to sort all parts into their respective "inventory code" which separates the parts by product type. Within each code the parts are listed in part number sequence. Then the print out is separated by product type to correspond to the division of product responsibility for each inventory analyst. Considerable paper is saved, but more importantly, each analyst's report lists only the parts he is concerned with.

II-2.2.3 Report Changes

(i) QTY ALLOC

Quantity allocated has been inserted in place of quantity on back order to improve clarity.

(ii) TOTAL USAGE

Total annual usage has been inserted instead of "usage code" because it is more meaningful and is required for order approval analysis.

(iii) FORECAST QTY

Forecast quantity per month has been inserted to aid in order approval analysis.

(iv) FORECAST CD

Forecast code is the "part code" 1, 2, or 4 which indicates how order points are regulated and was inserted to aid in order approval analysis.

(v) LEDGER ACCOUNT

Ledger account was added to facilitate order processing. Total cost was eliminated because it was seldom used.

(vi) OPD IND

Order indicator (*) was added in place of year to date receipts (YTD REC) which was of little value on the Stock Status.

An asterisk (*) prints in the "ORD IND" column if the program subtracts the order point from the available stock and the results are zero or negative.

Since each analyst receives only his own inventory stock status, the appearance of any asterisks indicates the need for some type of maintenance.

Normally, this would mean that the availability has dropped to the order point during the previous week. Thus the asterisk system has effectively eliminated another report - the Requisition Run.

In addition, the asterisk might indicate the need to correct the order point or the availability and not necessarily re-order.

Thus, each week upon receipt of the new stock status, the inventory analysts work through the report taking the necessary action to eliminate any asterisks.

If a replenishment order is called for, the analyst must complete a Stock Order Approval card and have it signed before he can enter the order on file and eliminate the asterisk. Should the card be lost temporarily or "in the system" from a previous order, the stock status will continue to show the asterisk every week until the file is updated.

This is a distinct advantage over the Requisition Run which issues a suggested order once, and should this report be lost or forgotten, the error could remain unnoticed for several weeks.

II-2.3 Shop Order Approval Procedure

As outlined above when a replenishment order is called for, a shop order approval card must be completed as shown in Figure II-3.

It must be approved by the Inventory Control Supervisor and the Product Manager prior to releasing the order. If approved, the card is placed into the system and serves as an instruction to order to the departments concerned.

The relationship between this new card and the stock status is clearly evidenced by the order approval data entered on the bottom line of each proposed order.

The data is as follows:

I/S	quantity in stock.
O/O	quantity on order not including the proposed order.
B/O	quantity allocated.
A/V	quantity available.
O/P	order point.
EOQ	economic order quantity.
L/T	lead time (weeks).

CAST. IRON CASING
14 X 12 X 21 PWO PUMP

98-232-980-801

ALLIS-CHALMERS
CANADA LIMITED

OCT 25/76

3-9809-5964

2

APR 30/77 SP2 HLB2

1 0 1 0 1 2 16 4 0 4 875.24

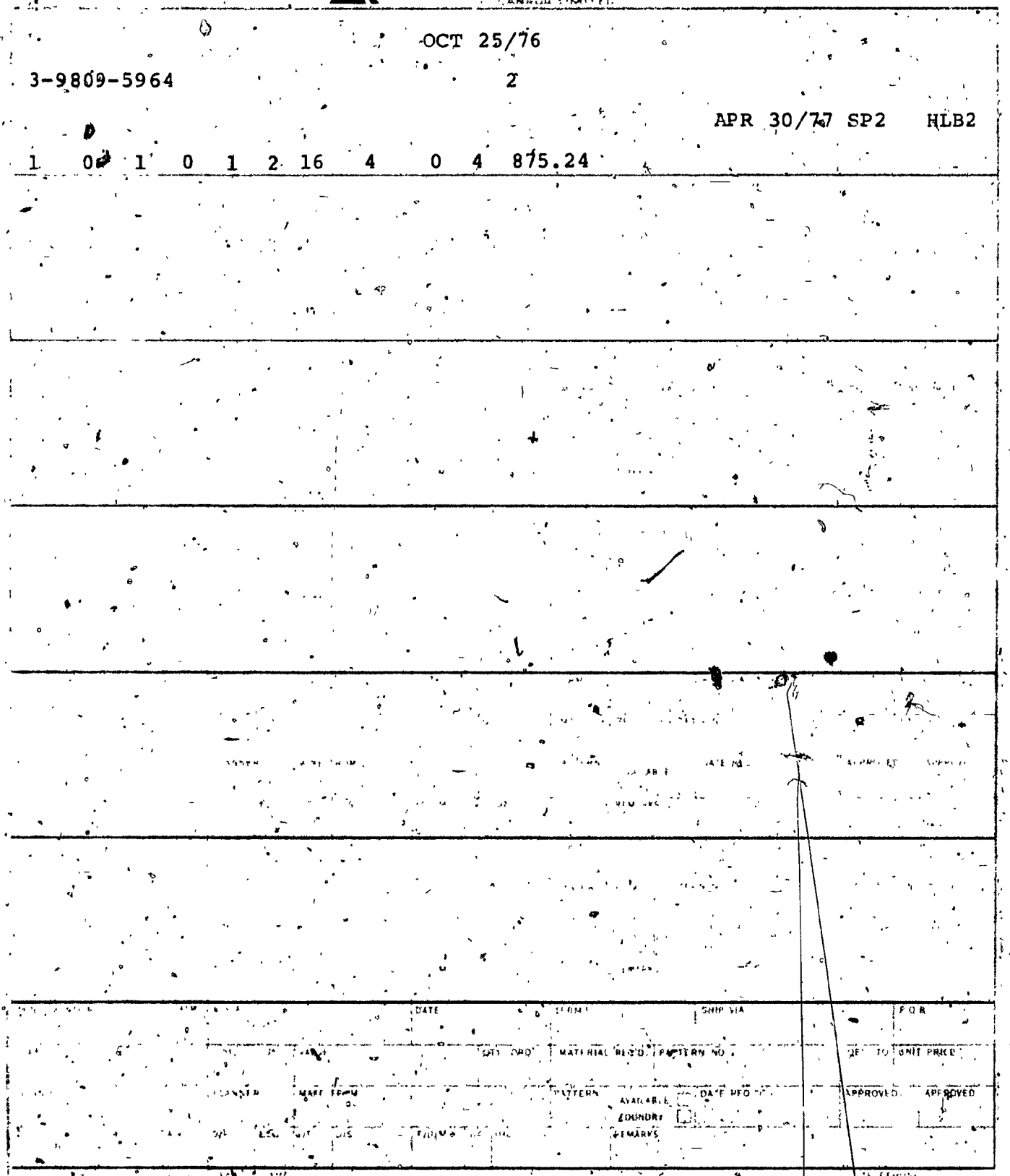

FIGURE II-3

U/S — annual usage.

F/U/MO — forecast usage per month.

I/C — inventory "part code".

U/C — unit cost.

All this information is transferred directly from the Stock Status and permits tighter control over new orders. It also permits the Product Manager to adjust manually set order points (part code 4) or to correct other parameters such as lead time or unit cost.

Originally, the shop order approval card did not require all the approval data mentioned above because it was assumed that computer generated orders would be justified 98% of the time. However, a combination of error detection and the inadequacy of the original forecasting system necessitated a more detailed analysis step prior to approval until these weaknesses could be corrected. This is discussed further in this chapter under "Inventory Forecast".

II-2.4 Customer/Shop Order Format Changes

The major format change was to add this information to the stock status and eliminate one report. However, the data has been completely re-organized and enhanced as shown in Figure II-2 (Page 53).

Open customer, shop, and purchase orders appear below a particular part stock status when any activity exists.

Using part number 98-232-980-801 as an example:

Open shop orders appear on the left (ex. 3-9809-5964)
Open customer orders appear on the right (ex. 2-9827-2016)

The headings are as follows:

ENT	the week number the shop or customer order was first entered on the file.
ON/OR	the quantity on order in the case of a shop order and the quantity allocated for a customer order.
DUE	the week number the shop order is scheduled for receipt or the week number the customer order is scheduled for shipment.
BCK/OR	the quantity remaining on a shop order to be received or the quantity remaining on a customer order to be shipped.

RECVD - the quantity received on a shop order.

SHPD - the quantity shipped on a customer order.

CLSD - the week number the shop or customer order was completely received or shipped.

REF ORDER - an alpha/numeric optional reference to be used to indicate the shop order applicable to a specific allocation or to list a customer's name opposite his order.

A minimum of four weeks closed order information and a maximum of seven weeks appears on the file at all times to effectively deal with order status inquiries.

II-3 INVENTORY FORECAST - ITEMS WITH NEW ORDER POINT

As described in the original system the inventory forecast program recalculates order points for all items whose "part code" equals one.

Upon investigation by manually checking many examples, it was determined that the inventory program does a creditable job when the "usage code" equals one and the exponential smoothing formula is used to adjust the order point.

However, this occurs only 20% of the time.

The remaining 80% is handled by averaging techniques which tend to understate the order point. A more sophisticated program should be developed but until this is done a temporary measure was to create "part code 4" which would set the order point manually and bypass the forecast program.

This was accomplished by resetting the "part code" for every item according to the following rules:

II-3.1 Item is Presently Part Code 1

Change to "part code" 4 if the part has "0" usage in 7 or more of the last 12 months.

This effectively transfers "usage code" 2 or 3 parts into the new "part code" 4.

II-3.2 Item is Presently "Part Code" 4

Change back to "part code" 1 if usage is indicated in at least 6 out of the last 12 months and the usage is 10 or more per year.

This covers the case where usage increases for a part such that it can be put back under the forecast program's control.

Since the parts left under the forecast program's control were reduced by 80%, the print out format was also revised to observe the stability of changes made by the computer each month.

Referring to Figure II-4 the new format reads as follows:

PART NUMBER	a drawing number describes each part.
SIZE	the size of the machine the part is used on.
DESCRIPTION	a brief description of the part.
UNIT COST	cost per item.
CURRENT DEMAND	number of parts ordered in the current period.
EOQ	the calculated economic order quantity.
LT	the lead time in weeks.
SF	the safety factor equal to one.

ALLIS-CHALMERS CANADA LTD INVENTORY FORECAST REPORT - ITEMS WITH NEW ORDER POINT DATE 01/27/77 PAGE 10

PART NUMBER	SIZE	DESCRIPTION	UNIT COST	CURRENT DEMAND	EOQ	LT	SF	OLD FOR	OLD ORD PT	OLD SAF STK	NEW FOR	NEW ORD PT	NEW SAF STK
98-231-084-501	66	6X6-GLAND-LIN NAT	91.62	11	20	6	1	9	28	12	9	27	11
98-231-085-501	66	6X6-SUCT-LIN NAT	92.51	25	20	6	1	9	24	8	11	30	10
98-231-108-501	34	3X3-C-SUCT-LIN NAT	52.59	8	50	6	1	12	36	14	12	35	13
98-231-109-501	34	3X3-C-GLAND-LIN NAT	61.37	2	20	6	1	10	29	11	9	27	11
98-231-115-501	54	5X4-C-SUCT-LIN- NAT	65.99	33	20	6	1	15	44	17	17	49	18
98-231-116-501	54	5X4-C-GLAND-LIN-NAT	70.10	19	20	6	1	12	35	13	13	36	13
98-231-120-501	86	8X6-SUCT-LIN NAT	107.44	24	25	8	1	13	42	12	14	45	13
98-231-121-501	86	8X6-SIDEPL- NAT	104.97	15	40	8	1	12	44	16	12	43	15
98-231-123-501	86	8X6-GLAND-LIN NAT	129.09	24	20	8	1	13	42	12	14	44	12
98-231-134-501	08	10X8-SUCT-LIN NAT	145.03	62	25	8	1	26	78	18	30	92	23
98-231-134-503	08	10X8-SUCT-LIN NEO	167.92	7	5	10	1	1	6	3	2	10	4
98-231-135-501	08	10X8-SIDEPL NAT	136.37	71	40	8	1	38	111	24	41	121	27
98-231-136-501	08	10X8-GLAND-LIN NAT	171.71	67	25	8	1	31	102	31	35	115	34
98-231-176-001		BRSHFTSLEEVE3X2SHN	29.87	4	36	16	1	2	15	3	2	9	0
98-231-586-801		CIRRGCOVER PW BRKT2	33.52	10	18	16	1	1	7	3	2	13	4
98-231-703-001	25	CIA-SHFT-SLV12X10 C	50.88	11	35	16	1	4	25	8	5	31	9
98-231-725-001	25	WATERSEAL-BUSH12X10C	36.32	10	27	14	1	3	12	1	4	17	2
98-231-726-001	25	CIA-GLAND 12X10 C	19.76	8	16	16	1	1	7	3	2	14	5
98-231-750-517	20	DEFLECT 12X10HML	51.08	0	28	18	1	4	24	5	4	25	6
98-232-674-801	PO	CIRRGCOVERBRKT2	25.29	0	40	16	1	6	33	7	5	30	8
98-232-805-001	PO	CIHALFGLANDBRKT3	22.62	2	30	16	1	2	15	6	2	14	5
98-232-805-004	PO	CF12MHALFGLANDBRKT3	69.44	6	30	24	1	5	48	16	5	47	15
98-232-957-802	PO	PLASTICSHIM BRKT2	4.45	5	100	15	1	14	79	23	13	75	23
98-233-017-003	PO	CF12MSLEEVEBRKT3	91.09	5	15	24	1	2	18	1	2	13	0
98-233-134-001	33	CIA-GLAND 3X3	14.09	24	90	16	1	14	64	4	15	71	6
98-233-184-001		STCOLLARS	4.55	6	30	10	1	2	9	3	2	10	4
98-233-193-501	PO	ALOILSLINGERBRKT2	4.94	6	100	15	1	9	59	23	9	57	21
98-233-346-801	PO	CISTBXCOVERBRKT1	110.86	6	10	16	1	2	11	2	2	12	3

FIGURE II-4

ALLIS-CHALMERS CANADA LIMITED

OLD FOR, ORD PT, SAF STK	the old forecast per month, order point, and safety stock.
NEW FOR, ORD PT, SAF STK	the new forecast per month, order point, and safety stock.

As evidenced by the old and new order points in Figure II-4 the rate at which the computer is changing the order points is relatively stable.

The problem remains to design a new more sophisticated program which can effectively handle a greater percentage of the parts transferred to "part code 4".

In addition, the new program should have the flexibility to provide more than one service level based on marketing needs or parts behaviour.

II-4 YEAR TO DATE CLOSED CUSTOMER/SHOP ORDERS

Every month, the Year to Date Closed Order Report is run which collects closed customer and shop orders off the stock status and adds them cumulatively to the closed order report.

This transfer takes place so that a minimum of four weeks and a maximum of seven weeks is left on the stock status at all times.

Each year the report is closed off during the July shutdown when the inventory is counted and stock levels are corrected. In this way the report can be referred to at any time between shutdowns permitting an accurate reconcilliation of receipts and shipments.

Referring to Figure II-5 the report provides the following data:

PART NUMBER	a drawing number describes each part.
DESCRIPTION	a brief description of each part.
ORDER/P.O. NUMBER	customer, shop, or purchase order number.
WEEK ENTR	the week number the order was entered on file.
QUANTITY ORDERED	the quantity ordered.

ALLIS-CHALMERS CANADA LTD ICOSRP02 YEAR TO DATE CLOSED ORDERS - 02 DATE 01/28/77 PAGE 53

--PART-NUMBER--	----DESCRIPTION-----	ORDER/PO --NUMBER---	WEEK ENTR	QUANTITY ORDERED	WEEK DLE	QUANTITY SHIPPED	QUANTITY RECEIVED	WEEK CLSD
98-231-584-501	OIL THR ASSY16X14X34	2-9817-1858	34	1.00		1.00		44
		2-9837-1571		1.00		1.00		37
		7-9800-0137	20	1.00		1.00		33
		7-9838-0243	39	1.00		1.00		40
		3-9829-6430	42	10.00	8		10.00	32
	*** TOTALS					4.00	10.00	
98-231-723-001	CIA-SHFT-SLV12X10 C	4-9800-7996	33	2.00		2.00		33
		4-9800-9515	45	3.00		3.00		45
		4-9818-7991	33	2.00		2.00		33
		4-9818-9013	33	1.00		1.00		40
		4-9818-9289	39	2.00		2.00		40
		4-9818-9341	40	3.00		3.00		40
		3-9860-6367	21	35.00	37		35.00	40
	*** TOTALS					13.00	35.00	
98-231-725-001	WATERSEAL-BUSH12X10C	4-9800-7167	36	4.00		4.00		36
		4-9818-9207	37	2.00		2.00		37
		4-9818-9346	40	1.00		1.00		40
		4-9818-9360	41	3.00		3.00		41
		4-9818-9381	41	2.00		2.00		41
		4-9818-9544	47	1.00		1.00		48
		4-9818-9556	47	2.00		2.00		47
		4-9818-9636	48	1.00		1.00		48
	*** TOTALS					16.00	.00	
98-231-726-001	CIA-GLAND 12X10 C	4-9818-9319	40	2.00		2.00		40
		4-9818-9449	43	2.00		2.00		43
		4-9818-9610	48	2.00		2.00		48
		7-9800-0167	25	2.00		2.00		31
	*** TOTALS					8.00	.00	
98-231-750-501	DEFLECTOR-ASSY12X10C	4-9800-7286	11	1.00		1.00		31
		4-9800-9382	41	2.00		2.00		41
	*** TOTALS					3.00	.00	
98-231-750-502	DEFLECTOR-ASSY14X12C	2-9817-1858	34	1.00		1.00		44
		2-9837-1571		1.00		1.00		37
		4-9800-7996	33	1.00		1.00		33
		4-9818-9314	40	2.00		2.00		40
		4-9818-9544	47	2.00		2.00		48
		4-9818-9640	48	1.00		1.00		48
		7-9800-0300	45	1.00		1.00		45
		7-9838-0220	38	2.00		2.00		34
		7-9838-0243	39	1.00		1.00		40
	*** TOTALS					12.00	.00	
98-231-750-503	DEFEECTOR-ASSY14X12C	4-9818-9406	42	1.00		1.00		42
	*** TOTALS					1.00	.00	
98-231-750-505	DEFLECTOR A 14X12X29	4-9818-9125	38	2.00		2.00		38
		7-9800-0167	25	3.00		3.00		31
		7-9800-0324	50	3.00		3.00		01
	*** TOTALS					8.00	.00	
98-231-750-517	[illegible]LECT 12X10HML	4-9818-9160	36	1.00		1.00		46

FIGURE II-5

ALLIS-CHALMERS CANADA LIMITED

WEEK DUE	the week number the order was due for completion.
QUANTITY SHIPPED	the quantity shipped on a customer order.
QUANTITY RECEIVED	the quantity received on a shop order.
WEEK CLOSED	the week number the order was completely finished.

II-5 CALCULATED ECONOMIC ORDER QUANTITY (EOQ)

Since the original inventory system was introduced, the desire was expressed to have a scientifically calculated EOQ for shop orders.

This information is now available and can be used in the following formula:

$$EOQ = \sqrt{\frac{2\ Cp\ D}{Ch(1-[D/R])}} \qquad \text{----------(1)}$$

Cp = set up cost per set up
D = demand rate in units/year
Ch = holding cost per unit per year
R = manufacturing rate in units/year

Since $R \gg D$ we can simplify this formula to read:

$$EOQ = \sqrt{\frac{2\ Cp\ D}{Ch}} \qquad \text{----------(2)}$$

Cp = set up cost per set up in dollars
D = demand rate in units per year
Ch = holding cost per unit per year (dollars per year)

II-5.1 Consider Cp:

Cp = operating cost per set up + manufacturing cost per set up

Operating Cost:

	COST PER SET UP
Purchasing	$ 23.08
Receiving	10.14
Inspection	1.33
Payables	5.03
	$ 39.58 say $40/set up

Manufacturing Cost:

Cost per hour =	$ 4.86 labour
	12.15 overhead
	$ 17.01 say $17/hour

Planned manufacturing set up times are available but must be corrected due to a 65% performance factor in the shop.

Therefore $Cp = (40 + \frac{S.U.}{.65} \times 17)$ ----------(3)

Where S.U. = planned set up time in hours.

II-5.2 Consider Ch:

Inventory holding cost %:

Insurance	0.1
Obsolesence	5.6
Storage & Handling	8.8
Money Cost	18.0
	32.5% say 32%

Therefore Ch = .32 X U.C. ----------(4)

Where U.C. = unit cost in dollars.

Substituting equation (3) & (4) into (2):

$$EOQ = \sqrt{\frac{2\left(40 + \frac{S.U. \times 17}{.65}\right)D}{.32\ U.C.}} \qquad \text{----------(5)}$$

Using equation (5) in which annual usage is substitued for "D" the demand rate and actual values are used for set up time and unit cost, we have the basis of the EOQ calculation as shown in Figure II-6.

The data is listed as follows:

PART NUMBER	a drawing number describes each part.
DESCRIPTION	a brief description of each part.
ORDER POINT	the order point.
FORECAST QTY	the forecast quantity per month.
FORECAST CODE	the part code (only considers 1 or 4).
UNIT COST	the unit cost to be used in EOQ formula.
TOTAL USAGE	the annual usage to be used in EOQ formula.
TOTAL SET UP	the total set up time in hours to be used in the EOQ formula.

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--PART-NUMBER--	----DESCRIPTION----	ORDER POINT	FORECAST QTY	CD	UNIT-COST	TOTAL USAGE	TOTAL SET-UP	OLD EOQ	NEW EOQ	LO-TIME X USAGE	----C O M M E N T S----
98-213-032-501	1045 SHAFT ASSY 3X3	7	2.0	1	65.29	29	7.37	23	25	7	
98-213-032-502	ST.ST.SHAFT 3X3	1-	.0	4	35.90	C		2	----		NO VALID USAGE DATA
98-213-155-501	1045SHAFT ASSY 3X3 C	1	.0	1	57.57	6	7.42	11	12	1	
98-213-906-501	IMPELL 2X2 NIHD	8	.0	4	63.04	4	-----	5	----		* NOT ON PROCESS SHEET FILE
98-230-151-001	BRSHFTSLV 14X12SH	1	1.0	4	145.27	17	1.55	10	7	4	
98-230-395-001	CIA-WAT-SLIN 5X5	30	5.0	1	22.19	61	2.19	50	40	19	
98-230-396-001	WATERSEAL-BUSH 5X4 C	40	11.0	1	16.71	137	3.05	55	75	34	
98-230-396-002	CE12H WATERSEAL-BUSH	4	1.0	4	84.80	3	1.42	10	4	1	
98-230-586-801	CIFRAMELINERBRKT1PW	8	.0	4	95.62	0		9	----		NO VALID USAGE DATA
98-230-587-801	CIPRGCOVER PW BRKT1	6	1.0	4	42.63	3	3.53	20	7		
98-230-588-801	CIPRGCOVER BRKT2PW	7	1.0	1	27.02	16	4.37	16	23	5	
98-230-609-001	CIGLAND BRKT3PW	1	1.0	4	22.76	0		6	----		NO VALID USAGE DATA
98-230-693-001	SSHLF GLAND 2PW	1	.0	4	26.47	4	1.60	8	8	1	
98-230-713-002	HALF GLAND CIA	8	3.0	4	22.96	8	2.00	12	14	2	
98-230-735-003	CISHAFTNUTRH10X8SJD	6	2.0	4	40.35	3	1.20	8	5		
98-230-735-004	CISHAFTNUTLH10X8SJD	10	3.0	4	30.71	3	1.20	10	6		
98-230-742-501	CIBRGADAPTER10X8SJD	6	1.0	4	118.99	11	1.80	8	7	3	
98-230-743-001	CIBRGADAPTOR10X8SJD	13	1.0	4	26.11	1	2.33	6	4		
98-230-744-501	CIBRGADAPTER10X8SJD	4	1.0	4	71.67	1	1.68	5	2		
98-230-745-001	CIBRGADAPTER10X8SJD	12	1.0	4	24.07	8	2.36	6	14	2	
98-230-748-502	410SHFTSLV 10X8SJD	12	1.0	4	72.00	4	1.20	11	4	1	
98-230-749-004	CIHALFGLAND 10X8SJD	22	5.0	1	30.18	34	1.70	30	24	11	
98-230-752-005	CSG RING 410STST	6	1.0	4	111.74	5	1.09	10	4	2	
98-230-753-005	410IMPRING10X8SJP	25	4.0	1	70.56	10	.50	16	6	4	
98-230-833-001	CIA-GLAND 14X12 C	13	3.0	1	26.58	14	2.21	40	17	4	
98-230-834-001	CIA-SEAL-CAG14X12 C	18	4.0	1	31.00	60	3.40	30	35	15	
98-230-834-002	WATERSEAL BUSH 14X12	0	.0	4	.00	0		1	----		INVALID UNIT COST
98-230-892-001	HALF GLAND AL. B12.	26	1.0	4	1.39	30	-----	100	70	7	PURCHASED

FIGURE II-6

ALLIS-CHALMERS CANADA LIMITED

OLD EOQ	the current EOQ in use.
NEW EOQ	the new proposed EOQ (calculated).
COMMENTS	lists messages explaining why EOQ was not calculated.

The EOQ program is run on request which is approximately once per month. Although the new EOQ may vary from the EOQ we use, it is only used as a management guide and does not necessarily mean the existing EOQ will be changed.

Since manufacture of certain parts are interdependent (e.g. parts to assemble pumps) EOQs are set up for individual parts based on assembly requirements and orders for spare parts. This is the reason why calculated EOQs are used as a guide but can not be permitted to automatically change the existing EOQs on the Parts File.

Additionally, the EOQ report lists all parts for which a calculation was not possible with the applicable reason listed under "comments".

II-6 USAGE

In order to perform analysis a usage report is utilized as shown in Figure II-7.

The report format is printed by inventory code which divides the total report into the respective product departments.

Figure II-7 demonstrates product "inventory code 2". Within each product report, the format is further divided into "part code" 1, 2, and 4. This is shown as "FOR CDE" 1 in Figure II-7.

The data contained in this report is as follows:

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PART NUMBER	DESCRIPTION	SIZE	UNIT COST	ABC CDE	FOR CDE	SAF FAC	LEAD TIME	ORDER POINT	EOQ	FCAST USAGE	LAST 12 MTHS TOTAL USAGE
98-231-134-501	10X8-SUCT-LIN NAT	08	145.03	A	1	1	8	92	25	10	
	LAST 12 MTHS USAGE 28 24 19 32 22 10 19 32 50							14	24	62	335
98-231-134-503	10X8-SUCT-LIN NEO	08	167.92	B	1	1	10	10	5	2	
	LAST 12 MTHS USAGE 3 5 1 3 0 0 5 0 1							3	0	7	28
98-231-135-501	10X8-SIDEPL NAT	08	136.37	A	1	1	8	121	40	41	
	LAST 12 MTHS USAGE 49 93 32 27 34 14 43 48 41							34	28	71	514
98-231-136-501	10X8-GLAND-LIN NAT	08	171.71	A	1	1	8	115	25	35	
	LAST 12 MTHS USAGE 17 32 63 16 63 2 39 24 53							40	8	67	424
98-231-136-503	10X8-GLAND-LIN NEO	08	197.04	B	1	1	10	17	5	4	
	LAST 12 MTHS USAGE 1- 1 7 9 6 0 9 0 0							1	0	2	34
98-231-584-501	OIL THR ASSY16X14X34	27	38.48	C	1	1	16	25	22	4	
	LAST 12 MTHS USAGE 3 0 1 0 0 0 1 1 0							0	0	2	8
98-231-723-001	CIA-SHFT-SLV12X10 C	25	50.88	A	1	1	16	31	35	5	
	LAST 12 MTHS USAGE 7 11 16 0 16 0 5 5 0							3	0	11	74
98-231-725-001	WATERSEAL-BUSH12X10C	25	36.32	B	1	1	14	17	27	4	
	LAST 12 MTHS USAGE 0 8 3 2 4 0 4 3 5							4	2	10	45
98-231-726-001	CIA-GLAND 12X10 C	25	19.76	C	1	1	16	14	16	2	
	LAST 12 MTHS USAGE 2- 6 0 0 4 0 0 2 2							2	0	8	26
98-231-750-502	DEFLECTOR-ASSY14X12C	27	33.62	C	1	1	18	14	15	2	
	LAST 12 MTHS USAGE 3 1 2 3 1 0 4 3 0							4	0	0	21
98-231-750-503	DEFLECTOR-ASSY14X12C	22	42.76	C	1	1	18	4	15	4	
	LAST 12 MTHS USAGE 0 2 1 0 0 0 0 0 1							0	0	0	4
98-231-750-517	DEFLECT 12X10HML	20	51.08	C	1	1	18	25	28	4	
	LAST 12 MTHS USAGE 4 7 3 0 0 0 2 1 0							10	0	0	27
98-233-134-001	CIA-GLAND 3X3	33	14.09	B	1	1	16	71	90	15	
	LAST 12 MTHS USAGE 12 8 4 8 16 4 38 16 4							28	10	24	172
98-233-145-001	CIA-GLAND 5X5	55	18.65	A	1	1	16	94	85	19	
	LAST 12 MTHS USAGE 20 26 20 8 32 15 53 20 26							16	6	20	262
98-233-404-001	SHAFT-SLEEVE 10X8C	08	38.34	A	1	1	12	52	45	10	
	LAST 12 MTHS USAGE 2 2 0 10 0 32 4 0 2							9	30	0	91
98-233-438-001	SHAFT-SLEEVE 8X6-CS	86	34.64	B	1	1	12	20	28	5	
	LAST 12 MTHS USAGE 29 9- 8 3 1 6 3 0 9							7	3	1	61
98-233-701-001	PED3-GLANDS	P3	7.40	A	1	1	20	122	95	18	
	LAST 12 MTHS USAGE 38 16 24 0 20 0 18 0 42							0	16	40	214
98-233-731-001	PED3-SEAL CAGE BUSH	03	2.73	B	1	1	8	46	125	12	
	LAST 12 MTHS USAGE 53 8 14 3 12 8 13 2 19							1	0	9	142
98-233-732-001	PED3-SEAL CAGE BUSH	03	3.22	B	1	1	8	50	50	14	
	LAST 12 MTHS USAGE 32 8 19 8 16 6 12 6 22							25	6	25	185

FIGURE II-7

II-6.1 LINE 1

PART NUMBER	a drawing number identifies each part.
DESCRIPTION	a brief description of each part.
SIZE	the size of the machine the part is used on.
UNIT COST	the latest cost per unit.
ABC CDE	designates the part as an A, B, C, or R item.
FOR CDE	the "Part Code" - can be 1, 2, or 4.
SAF FAC	the safety factor - always equal to one.
LEAD TIME	the lead time in weeks.
ORDER POINT	the order point.
EOQ	the economic order quantity currently in use.
FCAST USAGE	the current forecast usage per month.

II-6.2 LINE 2

Last 12 Mths Usage:

The usage in the last twelve months is listed. Since Figure II-7 is dated January 27, 1977, the figure on the extreme left represents the usage in February 1976. Moving to the right the monthly usages are listed up to January 1977.

The usage in each month represents the number of parts allocated during the month and may not correspond exactly to the number of parts actually shipped.

Thus the usage report is indicative of demand on a monthly basis.

Last 12 Mths Total Usage:

The figure on the extreme right represents the algebraic summation of the individual monthly usages. Although parts are seldom returned for credit (negative usage), this report takes these cases into account.

II-6.3 "Part Code 1"

In Figure II-7, part code 1 is represented in the "FOR CDE" column.

Therefore, all these parts are subject to order point revision by the inventory forecast program.

Although these parts have moderate to high usage and few months of zero usage, some deviate considerably from month to month causing the program to calculate high safety stocks and thus high inventory levels.

The safety stock could be reduced by leveling out the usage if in fact the demand is more stable than the usage report suggests.

Note that the usage is significantly lower in the sixth month from the left which represents July 1976. The reason for this is the annual two week Company shutdown in which no orders are processed and thus no usage is registered. A corresponding increase in usage occurs in August 1976, because six weeks of orders are processed in four weeks. A technique could be used to smoothen this out.

The next chapter will discuss a solution to usage stability and propose a more complex forecast program.

II-6.4 "Part Code 2"

In Figure II-8, part code 2 is represented in the "FOR CDE" column.

All parts in this category are not subject to reorder by the stock status and the order points are not reviewed by the inventory forecast. Instead the order points are fixed and designate the identification code the part is assigned to (example: order point = -5 refers to bin stock).

As evidenced by Figure II-8, these parts are static and remain on file as a reference or until their quantity in stock is used up or scrapped.

Periodic analysis of these parts is achieved by a special stock status which is discussed later in this chapter.

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PART NUMBER	DESCRIPTION		SIZE	UNIT COST	ABC CDE	FOR CDE	SAF FAC	LEAD TIME	ORDER POINT	EOQ	FCAST USAGE	LAST 12 MTHS TOTAL USAGE
98-430-807-138	GASKET BIN-STOCK		90	0.25	R	2	1	8	5-	25	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-430-807-139	GASKET BIN-STOCK		90	0.54	R	2	1	8	5-	25	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-430-807-140	GASKET 5X5SRL BINSTK			0.05	R	2	1	8	5-	300	0	
	LAST 12 MTHS USAGE	0 0 0		0	0	0	0	0	0	0	0	0
98-430-807-141	GASKET BIN-STOCK		90	0.17	R	2	0	0	5-	0	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-431-641-506	IMPELL-SCREW10XBCHEM			206.74	R	2	1	14	1-	10	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-431-858-502	STST SHFT ASS PED 1		P1	69.07	R	2	1	9	10-	10	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-431-966-501	SIDEPLATE 14X12X29C			0.00	R	2	1	10	1-	10	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-432-121-501	USF98432335501 DNR		20	392.55	B	2	1	15	2-	6	0	
	LAST 12 MTHS USAGE	0 0 3 0		0	0	0	0	0	2	0	0	5
98-432-124-001	USF 98432306 DNR		20	769.81	R	2	1	15	2-	6	1	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-432-128-801	SIDEPLGLAN12X10DNROB		20	330.65	R	2	1	11	10-	4	2	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-432-151-501	IMPELLER 16X14X3- OB		65	464.00	R	2	1	16	10-	2	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-432-370-501	CAS SUPP20X18X40 OB		10	590.74	R	2	1	20	10-	5	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	1	0	0	0	0	0	0	1
98-530-160-501	GLAN-CAS 6X6V OB		19	257.00	R	2	1	17	10-	8	2	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-530-220-001	PEDESTAL 6X6 OB		66	126.91	B	2	1	20	10-	10	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	1	0	0	1
98-530-221-001	PEDESTAL 5X4C OB		54	143.64	R	2	1	20	10-	6	2	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-530-222-001	PEDESTAL 8X6-C OB		86	279.50	R	2	1	16	10-	10	1	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-530-223-001	PEDESTAL 10X8-C OB		08	411.64	A	2	1	20	10-	10	1	
	LAST 12 MTHS USAGE	0 0 1 1		0	0	0	0	1	0	0	0	3
98-530-317-501	IMPELL 12X10 NEO OB		25	283.30	R	2	1	10	10-	5	2	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0
98-530-325-501	SUC-LIN 12X10C OB		25	305.46	R	2	1	10	10-	7	0	
	LAST 12 MTHS USAGE	0 0 0 0		0	0	0	0	0	0	0	0	0

FIGURE II-8

II-6.5 "Part Code 4"

In Figure II-9, part code 4 is represented in the "FOR CDE" column.

As discussed earlier, all parts in this category are active inventory but they do not turn over sufficiently to justify regulation of the order point by the exponential smoothing or averaging techniques currently in use.

Therefore, the order points are manually set and when the inventory stock status calls for replacement stock, the stock order approval card is completed and the order point is reviewed for a possible change at the same time.

Some of these order points could be automatically reviewed for recommended change and this is discussed in more detail in the next chapter.

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PART NUMBER	DESCRIPTION					SIZE	UNIT COST	ABC CODE	FOR CODE	SAF FAC	LEAD TIME	ORDER POINT	EOQ	FCAST USAGE	LAST 12 MTHS TOTAL USAGE
98-231-071-506	3X3 SUCT LINER CHEM						45.80	C	4	1	10	1-	2	0	
	LAST 12 MTHS USAGE	2	2	0	0		0	0	0	0	0	0	0	0	7
98-231-078-506	GLAND LINER5X5 - HYP					55	95.49	C	4	1	10	0	2	0	
	LAST 12 MTHS USAGE	0	3	1	0		0	0	0	0	2	0	1	2	0	9
98-231-079-507	GLAND LINER5X5 CHEM						85.56	C	4	1	10	1-	2	0	
	LAST 12 MTHS USAGE	0	1	1	0		0	0	0	0	1-	0	0	0	0	1
98-231-081-505	SUCT LINER 5X5 HYP					59	94.19	C	4	1	10	1-	2	0	
	LAST 12 MTHS USAGE	1	6	0	0		0	0	0	1	0	0	1	2	0	11
98-231-081-506	SUCT LINER 5X5 CHEM						84.24	C	4	1	10	1-	2	0	
	LAST 12 MTHS USAGE	0	1	0	0		0	0	0	0	0	0	0	0	0	1
98-231-084-503	6X6-GLAND-LIN NEO					66	107.16	C	4	1	10	8	5	0	
	LAST 12 MTHS USAGE	0	0	1	0		2	0	2	1	1	0	0	0	7
98-231-084-505	6X6 GL LIN CHEM					66	97.64	R	4	1	10	0	2	0	
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	0	0	0	0	0	0
98-231-085-503	6X6-SUCT-LIN NEO					66	108.62	C	4	1	10	5	5	0	
	LAST 12 MTHS USAGE	0	0	1	0		4	1	1	1	1	0	0	0	9
98-231-108-503	3X3-C-SUCT-LIN NEO					34	62.08	C	4	1	10	1-	5	1	
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	3	0	1	0	1	5
98-231-108-505	3X3-C SUCT LIN CHEM					34	56.39	R	4	1	10	1-	2	0	
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	0	0	0	0	0	0
98-231-109-505	3X3-C GLAN LIN CHEM					34	65.28	R	4	1	10	1-	2	0	
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	0	0	0	0	0	0
98-231-115-504	5X4 SUCTION LIN HYP					54	79.38	R	4	1	10	1-	5	0	
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	0	0	0	0	0	0
98-231-115-505	5X4 SUCTION LIN CHEM					54	70.61	R	4	1	10	1-	2	0	
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	0	0	0	0	0	0
98-231-116-503	5X4-C-GLAND-LIN-NEO					54	81.68	R	4	1	10	5	2	1	
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	0	0	0	1	1	1
98-231-116-504	GLAN-LIN-5X4-C HYP					54	83.53	C	4	1	10	0	5	0		
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	0	0	1	0	1	1
98-231-115-505	5X4 GLAND LIN CHEM					54	74.73	R	4	1	10	1-	2	0	
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	0	0	0	0	0	0
98-231-120-503	8X6-SUCT-LIN NEO					86	124.28	C	4	1	10	4	2	2	
	LAST 12 MTHS USAGE	0	2	0	2		0	0	0	0	0	0	0	0	0	4
98-231-120-505	SUCT LIN 8X6C CHEM					86	114.18	R	4	1	10	1-	2	0	
	LAST 12 MTHS USAGE	0	0	0	0		0	0	0	0	0	0	0	0	0	0
98-231-121-503	8X6-SIDEPL- NEO					86	115.21	C	4	1	10	4	2	2	
	LAST 12 MTHS USAGE	0	3	0	2		0	0	0	0	0	0	0	0	0	5

FIGURE II-9

II-7 PHYSICAL INVENTORY AUDIT

Every year during the July shutdown a complete physical inventory is taken of all parts kept in stock.

In preparation for this, the Data Processing Department issue a pair of cards for each item on the parts file. These cards have sequence numbers assigned to them to ensure none are lost.

One card is left with the part counted and the amount counted is recorded on the mating card which is sent in for processing.

During the inventory, the computer issues a Variance Report which lists all parts that have any variance between the physical amount counted and the recorded stock from the stock status.

The objective is to use the Variance Report to highlight possible parts missed or incorrect counts. During the several issues of the report, its size diminishes until the final report is accepted as the correct variance between physical and recorded stock.

Finally, the Physical Inventory Update Report is issued as shown in Figure II-10 which lists all the items in the Parts File with the actual variance.

The format is as follows:

DRAWING NO. — a drawing number identifies each part.

SEQ — a sequence number assigned to the physical inventory card.

ALLIS-CHALMERS CANADA LTD — PHYSICAL INVENTORY-UPDATE PARTS FILE — 08/02/76 — PAGE 400

DRAWING-NO	SEC	LEDGER	DESCRIPTION	COST	U/M		RECORDED	PHYSICAL	VARIANCE
98-231-699-801	00720	0603-31	NIHOSICEPLATE CHG	106.38	PC	QUANTITY		11	
				** TOTALS **		QUANTITY	11	11	0
						COST	1,170.18	1,170.18	.00
98-231-717-001	00721	0603-31	8"SHAFTSLEEVE	19.90	PC	QUANTITY		11	
				** TOTALS **		QUANTITY	11	11	0
						COST	218.90	218.90	.00
98-231-717-003	00722	0603-31	5"STSHFTSLEEVECHIP	34.88	PC	QUANTITY		5	
				** TOTALS **		QUANTITY	5	5	0
						COST	174.40	174.40	.00
98-231-723-001	02854	0603-91	CIA-SHFT-SLV12X10 C	50.88	EA	QUANTITY		4	
				** TOTALS **		QUANTITY	4	4	0
						COST	203.52	203.52	.00
98-231-725-001	02855	0603-91	WATERSEAL-BUSH12X10C	36.32	EA	QUANTITY		16	
				** TOTALS **		QUANTITY	16	16	0
						COST	581.12	581.12	.00
98-231-726-001	02856	0603-91	CIA-GLAND 12X10 C	19.76	EA	QUANTITY		44	
				** TOTALS **		QUANTITY	42	44	2-
						COST	829.92	869.44	39.52-
98-231-750-501	02857	0603-91	DEFLECTOR-ASSY12X10C	24.10	EA	QUANTITY		11	
				** TOTALS **		QUANTITY	11	11	0
						COST	265.10	265.10	.00
98-231-750-502	02858	0603-91	DEFLECTOR-ASSY14X12C	33.62	EA	QUANTITY		45	
				** TOTALS **		QUANTITY	45	45	0
						COST	1,512.90	1,512.90	.00
98-231-750-503	02859	0603-91	DEFEECTOR-ASSY14X12C	17.74	EA	QUANTITY		9	
				** TOTALS **		QUANTITY	9	9	0
						COST	159.66	159.66	.00
98-231-750-505	02860	0603-91	DEFLECTOR A 14X12X29	21.19	EA	QUANTITY		11	
				** TOTALS **		QUANTITY	11	11	0
						COST	233.09	233.09	.00
98-231-750-507	00723	0671-98	CIDEFLECTOR18X16SEOR	20.00	PC	QUANTITY		3	
				** TOTALS **		QUANTITY	3	3	0
						COST	60.00	60.00	.00
98-231-750-517	02861	0603-91	DEFLECT 12X10 ML	25.30	EA	QUANTITY		4	
				** TOTALS **		QUANTITY	4	4	0
						COST	101.20	101.20	.00
98-231-831-001	02862	0671-98	SEAL-BLS 5X4C 08	21.00	EA	QUANTITY		3	
				** TOTALS **		QUANTITY	2	3	1-
						COST	42.00	63.00	21.00-

FIGURE II-10

ALLIS-CHALMERS CANADA LIMITED

LEDGER	the ledger account number.
DESCRIPTION	a brief description of each part.
COST	the latest cost per unit.
U/M	the unit of measure.
RECORDED	the number of units recorded in stock prior to the physical count.
PHYSICAL	the number of units actually counted.
VARIANCE	the difference between the recorded and physical inventory. A positive number indicates a shortage and a negative number an excess.
COST	the dollar value of the variance based on the unit cost multiplied by the variance.

At the conclusion of the physical inventory, a special program is executed to replace the recorded quantity on the stock status with the physical quantity.

II-8 ANALYSIS REPORTS

Various analysis reports have been devised to extract and present information in a format which will help achieve a particular objective.

II-8.1 ABC Inventory Analysis

ABC analysis is a useful tool to focus attention on a relatively small percentage of the parts in inventory which are contributing largely to the dollar value of usage (sales).

Allis-Chalmers is a highly service oriented company and is therefore, eager to have high dollar usage parts in stock. The ABC analysis is sometimes used to set priorities on shop orders covering A items if the demand for the item is independent.

The definition used by Allis-Chalmers for A, B, and C items is as follows:

"A" - Annual usage times unit cost ranks the part within the top 80% of the total dollar value of the annual usage for the parts within one ledger account.

"B" - Annual usage times unit cost ranks the part within 5% to 15% of the total dollar value of the annual usage for the parts within one ledger account.

"C" - Annual usage times the unit cost ranks the part in the bottom 5% of the total dollar value of the annual usage for the parts within one ledger account.

"R" - The annual usage of the unit cost is equal to zero and therefore, the item is unranked.

Figure II-11 illustrates the format of the ABC report as follows:

ITEM COUNT	the relative rank of the item based on the annual usage times the unit cost.
PART NUMBER	the drawing number plus a brief description of the part.
UNIT COST	the latest cost per unit.
RECORDED QUANTITY	the number of units in stock.
RECORDED $ VALUE	the unit cost times the number of units in stock.
LAST 12 MTHS USAGE	the total annual usage.
LAST 12 MTHS $ USAGE	the unit cost times the total annual usage.
P TOTAL $ USAGE	last 12 mths $ usage per item divided by the cumulative last 12 mths $ usage for the complete ledger account times 100%.
CUMULATIVE/P. ITEMS	the item count divided by the total number of items in the ledger account times 100%.

ALLIS-CHALMERS CANADA LTD — ABC INVENTORY ANALYSIS — LEDGER ACCOUNT NO 0603-91 — DATE 11/19/76 PAGE 2

ITEM COUNT	PART NUMBER	UNIT COST	RECORDED QUANTITY	RECORDED $ VALUE	LAST 12 MTHS USAGE	LAST 12 MTHS $ USAGE	P TOTAL $ USAGE	CUMULATIVE P ITEMS	CUMULATIVE $ USAGE	CUMULATIVE P-$ USAGE	CODE
20	99-530-144-501 GLAND-HALF-CAS16X12C	1,759.31	0	0	7	12,315	1.3	5.6	431,815	44.1	A
21	98-052-577-501 CIA-SUC-CAS 5X5	270.03	0	0	41	11,071	1.1	5.9	442,886	45.2	A
22	98-200-039-511 ROT EL PAX3X15SHL	344.21	13	4,474	32	11,014	1.1	6.2	453,900	46.4	A
23	98-530-767-001 SUC-CASING 10XHX21HC	754.83	1	754	14	10,567	1.1	6.5	464,467	47.4	A
24	98-431-797-501 GLA[illegible]-CSG 5X4X14	251.13	0	0	40	10,045	1.0	6.8	474,512	48.5	A
25	98-432-192-501 SUCT-CASING12X1[illegible]X25	622.67	0	0	16	9,962	1.0	7.1	484,474	49.5	A
26	98-430-539-501 SHAFT-ASSY 14X12-C	447.05	1	447	21	9,386	1.0	7.3	493,862	50.4	A
27	99-530-323-501 SUC-HALF-CAS 12X10-C	741.84	0	0	12	8,902	0.9	7.6	502,764	51.4	A
28	99-431-768-501 SHAFT-ASSY14 SAE-C	309.62	27	8,359	28	8,669	0.9	7.9	511,433	52.2	A
29	98-530-719-501 SUCT-CAS 16X14X34	1,698.87	0	0	5	8,494	0.9	8.2	519,927	53.1	A
30	98-431-851-501 GLANDHALF CSG 3X3X10	118.44	0	0	70	8,290	0.8	8.5	528,217	53.9	A
31	98-331-991-501 PED-2 CYLINDER	112.66	49	5,520	73	8,224	0.8	8.8	536,441	54.8	A
32	99-530-857-501 FRAME[illegible]NER2[illegible]X40	1,121.11	0	0	7	7,847	0.8	9.0	544,288	55.6	A
33	98-530-722-501 GLAN-CAS 16X14X34	1,949.92	0	0	4	7,799	0.8	9.3	552,087	56.4	A
34	98-430-929-501 BRG-CYL 12X10-C	368.93	14	5,165	21	7,747	0.8	9.6	559,834	57.2	A
35	98-530-145-501 FRAME-ASSY 14X12C	1,503.56	0	0	5	7,517	0.8	9.9	567,351	57.9	A
36	98-431-629-501 SHAFT-ASSY 10X8-CS	352.60	2	705	21	7,404	0.8	10.2	574,755	58.7	A
37	98-331-958-903 PED 2 SHAFT SLEEVE	23.43	0	0	314	7,357	0.8	10.5	582,112	59.5	A
38	98-332-402-501 BELTGUARD ASSYRX6X18	83.14	57	4,738	87	7,233	0.7	10.7	589,345	60.2	A

FIGURE II-11

ALLIS-CHALMERS CANADA LIMITED

CUMULATIVE $ USAGE — the summation of all "last 12 mths $ usage" up to and including the item being reviewed.

CUMULATIVE P $ USAGE — the summation of all "percent total $ usage" up to and including the item being reviewed.

CODE — the A, B, C, or R code.

Figures II-11 to II-14 provide examples of A, B, C, and R items respectively for ledger account 0603-91.

A summary of this report is as follows:

CODE	NUMBER OF ITEMS	PERCENT OF TOTAL ITEMS	PERCENT OF TOTAL $ USAGE
A	79	22.3%	80%
B	87	24.6%	15%
C	131	37.0%	5%
R	57	16.1%	0%
TOTAL	354	100.0%	100%

If the A code was changed from 80% to 60%, only 10.5% of the parts would represent 60% total dollars usage in the account.

R items are almost always the result of zero annual usage and this report is useful in identifying parts which should be declared obsolete and transfered out of the account.

ALLIS-CHALMERS CANADA LTD — ABC INVENTORY ANALYSIS — LEDGER ACCOUNT NO 0603-91 — DA[illegible]/19/76 PAGE 6

ITEM COUNT	PART NUMBER	UNIT COST	RECORDED QUANTITY	RECORDED $ VALUE	LAST 12 MTHS USAGE	LAST 12 MTHS $ USAGE	P TOTAL $ USAGE	CUMULATIVE P ITEMS	CUMULATIVE $ USAGE	CUMULATIVE P $ USAGE	CODE
80	98-332-141-002 NIHARD SUCT HP121025	242.00	7	1,694	12	2,904	0.3	22.6	784,573	80.1	B
81	98-332-270-501 BOT SECTASSY12X10X25	236.98	5	1,184	12	2,843	0.3	22.9	787,416	80.4	B
82	98-234-113-001 PED-0 [illegible]86 MSG	31.15	47	1,464	90	2,803	0.3	23.2	790,219	80.7	B
83	98-110-455-001 CTA GL[illegible] 10X8 C	22.05	25	551	124	2,734	0.3	23.4	792,953	81.0	B
84	98-234-[illegible]-003 PED-1 JACK SCREW	7.25	123	891	368	2,668	0.3	23.7	795,621	81.3	B
85	98-332-401-501 BELTGUARD ASSY5X5X14	55.10	34	1,873	48	2,644	0.3	24.0	798,265	81.5	B
86	98-[illegible]-958-501 CTA GL[illegible]-CA[illegible] 5X5 V	368.81	10	3,698	7	2,581	0.3	24.3	800,846	81.8	B
87	98-211-293-501 10+5-SHAFT-ASSY-5X5	83.29	5	416	31	2,581	0.3	24.6	803,427	82.1	B
88	98-[illegible]-597-001 CTA-SELNSER 5X4-C	30.00	1	30	86	2,580	0.3	24.9	806,007	82.3	B
89	98-431-987-501 1045 SHAFT 2X2X10SPL	36.80	18	662	70	2,576	0.3	25.1	808,583	82.6	B
90	98-331-126-806 SHAFT-SLEEVE 5X4-C	20.15	6	120	122	2,458	0.3	25.4	811,041	82.8	B
91	98-331-459-806 SISI SHFT SLV PED 3	110.29	4	441	22	2,426	0.2	25.7	813,467	83.1	B
92	98-331-963-501 SHAFT ASSY 6X6X15SPL	150.42	41	6,167	16	2,408	0.2	26.0	815,873	83.3	B
93	98-311-126-806 SHAFT-SLEEVE 6X6	21.04	22	462	114	2,398	0.2	26.3	818,271	83.6	B
94	98-331-992-501 PED-2 MOTOR BASE	28.10	34	955	85	2,388	0.2	26.6	820,659	83.8	B
95	98-332-010-501 PED-1 MOTOR BASE	25.56	44	1,124	92	2,351	0.2	26.8	823,010	84.1	B
96	98-210-834-001 CTA-SEAL-CA[illegible]14X12 C	31.00	0	0	75	2,325	0.2	27.1	825,335	84.3	B
97	98-332-400-501 BELTGUARD ASSY3X3X10	52.39	24	1,257	44	2,305	0.2	27.4	827,640	84.5	B
98	98-110-404-001 CTA WAT-S-[illegible] 10X8 C	39.21	12	422	64	2,253	0.2	27.7	829,893	84.8	B

FIGURE II-12

ALLIS-CHALMERS CANADA LIMITED

ALLIS-CHALMERS CANADA LTD — ABC INVENTORY ANALYSIS — LEDGER ACCOUNT NO 0603-91 — DATE 11/19/76 PAGE 11

ITEM COUNT	PART NUMBER	UNIT COST	RECORDED QUANTITY	RECORDED $ VALUE	LAST 12 MTHS USAGE	LAST 12 MTHS $ USAGE	PERCENTAGE $ USAGE	CUMULATIVE ITEMS	CUMULATIVE $ USAGE	CUMULATIVE % $ USAGE	CODE
167	98-211-439-501 CIA-SUB-CAS 2X2	127.50	8	1,020	7	892	0.1	47.2	931,352	95.1	C
168	98-234-265-001 STST WATER-CTRL PED 3	52.20	4	204	17	887	0.1	47.5	932,239	95.2	C
169	98-432-217-501 SHAFT ASSY 14X12X29	175.50	6	1,053	5	877	0.1	47.7	933,116	95.3	C
170	98-235-267-501 RH SUPPORTASSY 16X18	10.49	84	914	79	860	0.1	48.0	933,976	95.4	C
171	98-219-758-001 CIA-GLAND-SET 6X6	12.14	54	655	70	849	0.1	48.3	934,825	95.5	C
172	98-210-488-001 CIA-PRI-CYL 3X3	90.05	2	180	9	810	0.1	48.6	935,635	95.6	C
173	98-332-014-501 MOTOR BASE 2X2X.05RL	24.21	48	1,162	33	798	0.1	48.9	936,433	95.7	C
174	99-112-038-501 CIA-SLEEVE? 10X9-C	14.51	29	420	54	783	0.1	49.2	937,216	95.7	C
175	98-112-595-001 CIA-END-PL 5X4-C	23.49	0	0	33	775	0.1	49.4	937,991	95.8	C
176	98-234-408-001 GLAND 12X10RML	21.50	48	1,032	36	774	0.1	49.7	938,765	95.9	C
177	98-019-411-001 CIA-GLAND-SET 3X3-C	13.31	0	0	58	771	0.1	50.0	939,536	96.0	C
178	98-331-126-905 SHAFT-SLEEVE 3X3-C	19.11	0	0	40	764	0.1	50.3	940,300	96.0	C
179	98-134-811-501 PED-3 END COVER IN	15.22	31	471	50	761	0.1	50.6	941,061	96.1	C
180	98-111-628-001 CIA-MAT-SEALHUS 8X6-C	15.45	26	401	48	741	0.1	50.8	941,802	96.2	C
181	98-431-644-501 SHAFT-ASSY 8X6-CS	80.81	12	969	9	727	0.1	51.1	942,529	96.3	C
182	98-019-777-001 CIA-SHAFT-SL 3X3-V	22.51	0	0	32	720	0.1	51.4	943,249	96.3	C
183	98-110-406-002 ST ST MAT SEAL HUS	79.37	7	555	9	714	0.1	51.7	943,963	96.4	C
184	98-330-303-002 CIA-PRI-END-PL 5X5	19.14	0	0	37	708	0.1	52.0	944,671	96.5	C
185	98-110-464-001 CIA ENDPL 2X2	24.93	23	573	28	698	0.1	52.3	945,369	96.6	C

FIGURE II-13

ALLIS-CHALMERS CANADA LIMITED

ALLIS-CHALMERS CANADA LTD — ABC INVENTORY ANALYSIS — LEDGER ACCOUNT NO 0603-91 — DATE 11/19/76 PAGE 23

ITEM COUNT	PART NUMBER	UNIT COST	RECEIPTED QUANTITY	RECEIPTED $ VALUE	LAST 12 MTHS USAGE	LAST 12 MTHS $ USAGE	P TOTAL $ USAGE	CUMULATIVE P ITEMS	CUMULATIVE $ USAGE	CUMULATIVE P $ USAGE	CODE
337	98-130-763-001 SUCT-FLA 3X3-C	0.00	4	0	0	0	0.0	95.2	979,090	100.0	R
338	98-910-612-001 SUCT PLOT 12X10-CONN	6.48	1	6	0	0	0.0	95.5	979,090	100.0	R
339	98-233-152-002 ST-JACK-SCREW 10X8C	7.90	24	187	0	0	0.0	95.8	979,090	100.0	R
340	98-233-152-003 ST-JACK-SCREW	18.83	16	301	0	0	0.0	96.0	979,090	100.0	R
341	98-213-156-001 CRG-HD -CYL 3X3 C	48.36	7	338	0	0	0.0	96.3	979,090	100.0	R
342	98-212-761-001 CRG-HD -CYL 6X6	148.45	6	890	0	0	0.0	96.6	979,090	100.0	R
343	98-219-232-002 ST-STG-HARF 3X3	35.90	0	0	0	0	0.0	96.9	979,090	100.0	R
344	98-231-471-002 ST-JACK-SCREW 3X3-C	4.10	69	282	0	0	0.0	97.2	979,090	100.0	R
345	98-231-471-101 ST-JACK-SCREW 2X2	4.85	29	140	0	0	0.0	97.5	979,090	100.0	R
346	98-233-152-001 ST-JACK-SCREW	11.32	13	147	0	0	0.0	97.7	979,090	100.0	R
347	98-239-145-003 CRANK-LEVER 5X5	30.40	0	0	0	0	0.0	98.0	979,090	100.0	R
348	98-230-734-002 MATERIAL SUPH 14X12	0.00	1	0	1	0	0.0	98.3	979,090	100.0	R
349	98-900-368-024 2XCXIDORLPLUMPHYP3165	0.00	0	0	0	0	0.0	98.6	979,090	100.0	R
350	98-110-666-002 STST-SLING 2X2	36.36	0	0	0	0	0.0	98.9	979,090	100.0	R
351	98-110-668-002 STST-MAT-S-HUS 2X2	29.44	0	0	0	0	0.0	99.2	979,090	100.0	R
352	98-110-445-001 CRA-DIG-PLAS 5X5	36.65	5	183	0	0	0.0	99.4	979,090	100.0	R
353	98-130-272-001 CRA-END-PL 2X2 V	17.82	11	196	0	0	0.0	99.7	979,090	100.0	R
354	00-619-207-440 STUDS 12X1.75ML	0.00	0	0	0	0	0.0	100.0	979,090	100.0	R
	TOTAL ACCOUNT NO 0603-91			291,336		979,090	*****				

FIGURE II-14

ALLIS-CHALMERS CANADA LIMITED

II-8.2 Surplus Stock Analysis

Every six months, Allis-Chalmers is required to declare any additional surplus inventory in stock.

To achieve this a special stock status is requested which lists possible surplus stock.

Since active parts are listed on the parts file in "part code 1 or 4" the program reviews every item in these two codes and performs the following calculation:

[QUANTITY IN STOCK - (2 X ANNUAL USAGE)] = "X"

If "X" is zero or negative the part is ignored.

If "X" is positive the program prints the stock status for the part and also prints the value of "X" in the column reserved for the "ORD CDE" as shown in Figure II-15.

Thus the value of X is an indication of the inventory on hand in excess of two years usage.

Using this information, the product managers can quickly assess which items should be written off as surplus stock.

ALLIS-CHALMERS CANADA LTD — SPECIAL STOCK STATUS -LOW ANNUAL USAGE — DATE 11/19/76 — PAGE 126

PART NUMBER	DESCRIPTION	TOTAL ST CK	QTY ON ORDER	QTY ON B.O.	AVAIL STOCK	ORDER POINT	EOQ	LD TM	TOT	USAGE QTY	FCST	FCST CODE	UNIT COST	LEDGER ACCOUNT	STK ADJ	ORD QTY
98-231-[illegible]-001	GLAN LINER 10X1 HYP	2.00	0.00	0.00	2.00	1	2	10		0	0	4	201.10	0603-95	1	2
98-231-144-001	NIPDSIDEPLATE 4X3CW1	26.00	0.00	0.00	26.00	20	20	33		1	4	4	96.77	0603-31	0	24
98-231-190-019	PACKING GARLOCK	32.00	0.00	0.00	32.00	12	12	4		4	0	4	9.35	0603-98	0	24
98-231-190-020	PACKING GARLOCK	49.00	0.00	0.00	49.00	5	6	4		0	1	4	11.25	0603-98	0	49
98-23[illegible]-501	CIGASING 12X12SE	1.00	0.00	0.00	1.00	1-	1	16		0	0	4	1956.15	0603-31	0	1
98-231-554-001	CIPGESOPL P B4XT2	1.00	8.00	0.00	9.00	1	6	16		0	0	4	14.88	0603-31	0	1
98-231-555-001	CIPGSCOVER P B4XT3	9.00	16.00	2.00	25.00	15	18	16		4	2	4	19.47	0603-31	0	1
98-231-717-001	BRSHAFTSLEEVE	10.00	0.00	0.00	10.00	5	10	15		2	0	4	19.90	0603-38	0	6
98-231-[illegible]-001	CIA-GLAND -12X10 C	38.00	4.00	0.00	42.00	4	16	16		18	1	1	19.76	0603-91	0	2
98-231-871-001	ST-JACK-SCREW 2X2	29.00	0.00	0.00	29.00	6	30	8		0	4	4	4.85	0603-91	0	29
98-231-87[illegible]-00	ST-JACK-SCREW 3X3-C	69.00	0.00	0.00	69.00	5	60	8		0	2	4	4.10	0603-91	0	69
98-231-939-501	CICASING10X8X17CUST	2.00	0.00	0.00	2.00	1-	2	16		0	0	4	1175.42	0603-31	0	2
98-232-052-501	CICASING8X8X12CUSTT	1.00	0.00	0.00	1.00	0	2	16		0	0	4	377.47	0603-31	0	1
98-232-056-501	CICSG12X10X12CUSTT	2.00	0.00	0.00	2.00	1	2	16		0	0	4	474.12	0603-31	0	2
98-232-058-501	CICSG 8X8X17CUSTT	1.00	0.00	0.00	1.00	1-	2	16		0	0	4	506.20	0603-31	0	1
98-232-14[illegible]-001	BRHALFGLAND	62.00	0.00	0.00	62.00	40	20	12		24	1	4	16.10	0603-31	0	14
98-232-527-501	STSLINGER BRGEN1P	7.00	0.00	0.00	7.00	-4	18	12		2	0	4	3.50	0603-31	0	3
98-232-527-501	STSLINGER BRGEN3P	14.00	0.00	1.00	13.00	2	10	12		5	1	4	12.70	0603-31	0	4
98-232-652-002	CICSGRING16X14.0	3.00	0.00	0.00	3.00	1-	4	16		0	0	4	65.34	0603-31	0	3
98-232-654-001	CIPGESOPL16X14SD	6.00	0.00	0.00	6.00	1-	6	16		2	1	4	27.49	0603-31	0	2
98-232-667-00[illegible]	BR CSG RING 6X8PE	13.00	0.00	0.00	13.00	6	12	22		3	3	1	19.74	0603-31	0	7
98-232-664-00[illegible]	BRCSGWEARING	5.00	0.00	0.00	5.00	2	6	12		0	0	4	15.22	0603-31	0	5
98-232-868-005	SSCSCWNGRING 10X8PE	14.00	0.00	0.00	14.00	12	12	40		4	1	1	56.57	0603-31	0	6
98-232-890-907	CGIPCASG12X10X17PWD	1.00	0.00	0.00	1.00	0	1	33		0	0	4	2077.34	0603-31	0	1
98-232-980-30[illegible]	CF12PCSG14X12X21	0.00	1.00	2.00	2.00	0	2	24		1	0	4	2929.65	0603-31	0	1
98-232-981-801	CI CSG14X14X21PWD	2.00	0.00	0.00	2.00	0	2	16		0	0	4	932.02	0603-31	0	2
98-233-132-002	CISEALCAGE3X2.5SK	110.00	0.00	0.00	106.00	25	20	16		20	6	4	7.57	0603-31	0	24
98-233-175-001	BRCSCRING3X2.5CJ	1.00	0.00	0.00	1.00	0	1	12		0	0	4	15.03	0603-31	0	1

FIGURE II-15

ALLIS-CHALMERS

II-8.3 Obsolete Stock Analysis

In the previous section on the Usage Report, items whose part code equals 2 were explained briefly.

These parts are static and remain on file as a reference or until the quantity in stock is used up.

Since obsolete stock must be declared at the same time as surplus stock, special order points are assigned to the part code 2 items so they may be separately retrieved.

The order points used are as follows:

II-8.3.1 ORDER POINT = -2: These items are designated DNR (do not reorder) because of design or drawing number changes. They may remain in an active ledger account but must be reviewed every six months for consideration as obsolete inventory.

II-8.3.2 ORDER POINT = -10: These items have already been declared obsolete ("OB") but the parts have not been physically scrapped and therefore, the parts remain on the stock status. Normally, if the stock is subsequently used up, the part is deleted from the file unless it is needed as a reference. In this case, the order point would be changed to -30 which is for reference only.

II-8.3.3 ORDER POINT = -20: Items left over from contracts which are of value are written off against the contract but are set up as a special stock ("SS") item for possible future use. These items are kept on file until the last item is used and then deleted.

Figure II-16 represents the special stock status for do not reorder (DNR) items whose order point = -2.

If it is decided to declare a specific part obsolete from this report, the order point is changed to -10 and the part is written off by transferring the dollar value of the quantity in stock to an obsolete ledger account.

This report also permits housecleaning. For example, all parts listed should have "DNR" in the description field and a "part code" equal to 2.

ALLIS-CHALMERS CANADA LTD — SPECIAL STOCK STATUS - ORDER POINT - 2 - DATE 11/19/76 — PAGE 18

PART NUMBER	DESCRIPTION	TOTAL STOCK	QTY ON ORDER	QTY ON B.O.	AVAIL STOCK	ORDER POINT	FOQ	LD TM	USAGE TOT	USAGE QTY	FCST FCST	FCST CODE	UNIT COST	LEDGER ACCOUNT	STK ADJ	3RD COD
98-111-625-002	GLAND H6STST DNR	6.00	0.00	0.00	6.00	2-	1	5	0	0	0	2	0.00	0671-98	0	
98-130-362-006	NEOPRENE SLINGER	65.00	0.00	0.00	65.00	2-	15	12	9	2	2	2	2.22	0603-32	0	
98-130-612-001	SUCT FOOT 12X10-CDNR	1.00	0.00	0.00	1.00	2-	5	9	0	0	0	2	6.48	0603-91	0	
98-131-696-001	CHARGE-OPL 8X6ST DNR	0.00	0.00	0.00	0.00	2-	6	16	0	0	0	2	13.54	0603-31	0	
98-230-300-001	BRHLFGL4ND12X10SHMD	8.00	0.00	0.00	8.00	2-	1	25	0	0	0	2	0.00	0603-31	0	
98-231-358-501	CICASING 12X10SH	0.00	0.00	0.00	0.00	2-	2	16	0	0	0	4	2982.80	0603-31	0	
98-232-663-003	CTESGWRGAING DNR	0.00	0.00	0.00	0.00	2-	6	16	0	0	0	2	2.11	0603-31	0	
98-232-735-406	STSTCASING 6X5PE DNR	1.00	0.00	0.00	1.00	2-	1	10	0	0	0	2	200.50	0671-98	0	
98-232-992-810	CG3M CSG 16X14X21DNR	0.00	0.00	0.00	0.00	2-	2	24	0	0	0	2	0.00	0603-31	0	
98-233-278-001	BR SHNUT12X10SJE DNR	2.00	0.00	0.00	2.00	2-	1	12	0	0	0	2	22.26	0671-98	0	
98-233-279-001	BR SHNUT12X10SJE DNR	2.00	0.00	0.00	2.00	2-	1	12	0	0	0	2	17.96	0671-98	0	
98-233-346-904	NIST8XCOVERBRK71PNR	0.00	0.00	0.00	0.00	2-	1	9	1-	0	0	4	70.07	0603-31	0	
98-235-047-001	USE 98-332-562-501DNR	0.00	0.00	0.00	0.00	2-	30	16	3-	2	2	2	23.42	0603-91	12	
98-330-464-803	NR STF8XCOVER2PW DNR	0.00	0.00	0.00	0.00	2-	1	12	1	0	0	2	75.80	0671-98	0	
98-331-098-001	BR IMP 4X3PN DNR	1.00	0.00	0.00	1.00	2-	1	12	0	0	0	4	59.95	0671-98	0	
98-331-107-001	CIA-BRG-COVER DNR	3.00	0.00	0.00	3.00	2-	10	15	0	2	2	2	24.39	0603-91	0	
98-331-185-011	STELL.SHFT-SLV5X4SRL	1.00	0.00	0.00	1.00	2-	1	1	0	0	0	2	0.00	0671-98	0	
98-331-617-803	CG8SIDCPL12X10X12DNR	1.00	0.00	0.00	1.00	2-	1	9	0	0	0	2	404.16	0603-31	0	
98-331-734-001	BR IMP 3X2SHN DNR	0.00	0.00	0.00	0.00	2-	2	14	0	0	0	2	189.00	0603-31	0	
98-332-134-803	DNR USE 98332134806	0.00	0.00	0.00	0.00	2-	1	33	1	0	0	2	428.73	0603-31	0	
98-332-237-906	CG3MSIDPL16X14X21DNR	0.00	0.00	0.00	0.00	2-	3	24	0	0	0	2	0.00	0603-31	0	
98-332-333-502	SUCT LIN 20X18X40NEO	1.00	0.00	0.00	1.00	2-	10	10	0	0	0	2	265.98	0603-95	1	
98-332-334-502	GLA LIN 14X12X29-NEO	1.00	0.00	0.00	1.00	2-	10	10	0	0	0	2	283.80	0671-98	1	
98-432-121-501	USE98432305501 DNR	4.00	0.00	0.00	4.00	2-	6	15	3	0	0	2	392.55	0603-91	0	
98-432-124-001	USE 98432306 DNR	0.00	0.00	0.00	0.00	2-	6	15	0	1	2	2	769.81	0671-98	0	
98-530-264-502	BRCASING 5X4PW DNR	2.00	0.00	0.00	2.00	2-	1	12	0	0	0	2	519.27	0671-98	0	
98-530-344-003	BRIMP 8X6PWJCRDNR	2.00	0.00	0.00	2.00	2-	1	12	0	0	0	2	241.35	0671-98	0	
98-530-477-010	BRIMP 10X8X17PWQ DNR	1.00	0.00	0.00	1.00	2-	1	12	0	0	0	2	95.00	0671-98	0	

FIGURE II-16

ALLIS-CHALMERS CANADA LIMITED

Figure II-17 represents the special stock status for obsolete (OB) items whose order point = -10.

Basically this report is reviewed semi-annually for possible deletion of parts whose stock has been used up.

Also housecleaning can be checked. All parts listed should have "OB" in the description field and a "part code" equal to 2.

ALLIS-CHALMERS CANADA LTD — SPECIAL STOCK STATUS - ORDER POINT = 10- — DATE 11/19/76 — PAGE 16

PART NUMBER	DESCRIPTION		TOTAL ST OK	QTY ON ORDER	QTY ON B.O.	AVAIL STOCK	ORDER POINT	EOQ	LD TM	USAGE TOT	USAGE QTY	FCST FCST	FCST CODE	UNIT COST	LEDGER ACCOUNT	STK ADJ	ORD COD
98-110-882-001	SUC-FLG-3X3	OB	12.00	0.00	0.00	12.00	10-	5	15	0	2	2		4.00	0671-98	0	
98-110-883-001	CON-FLG-2X2	OB	12.00	0.00	0.00	12.00	10-	5	15	0	2	2		5.00	0671-98	0	
98-110-884-001	CI DISCH FLGE 3X3	OB	3.00	0.00	0.00	3.00	10-	5	15	0	1	2		15.43	0671-98	0	
98-110-886-001	CIA-DIS-FLAN 2X2	OB	3.00	0.00	0.00	3.00	10-	3	15	0	2	2		7.46	0671-98	0	
98-111-325-001	BRCSCMPRSG SSHM		2.00	0.00	0.00	2.00	10-	1	18	0	0	2		19.97	0671-98	0	
98-111-395-002	STSTRETNUT SS-MB		1.00	0.00	0.00	1.00	10-	1	18	0	0	2		47.82	0671-98	0	
98-111-472-001	3145S SLEEVE	DOR-V	1.00	0.00	0.00	1.00	10-	1	12	0	0	2		0.00	0671-98	1	
98-111-627-001	CIA-DIS-FLAN 8X6C	OB	5.00	0.00	0.00	5.00	10-	6	12	1	2	2		34.15	0671-98	0	
98-111-675-001	SUC-FL 10X8C	OB	1.00	0.00	0.00	1.00	10-	2	16	0	2	2		28.00	0671-98	0	
98-111-885-001	STSTSHAFT-SLV10X8	OB	0.00	0.00	0.00	0.00	10-	3	15	0	2	2		127.62	0671-98	0	
98-111-889-002	RET-RING 10X8-C	OB	2.00	0.00	0.00	2.00	10-	5	17	7	2	2		14.00	0671-98	0	
98-111-995-002	BR SHAFTSLEEVE	SSD	1.00	0.00	0.00	1.00	10-	1	18	0	0	2		57.96	0671-98	0	
98-112-874-001	CI DISC-FLA 5X5	OB	6.00	0.00	0.00	6.00	10-	10	16	0	1	2		47.17	0671-98	0	
98-112-[illegible]-003	SS SLINGER8X4NM3X4		1.00	0.00	0.00	1.00	10-	1	12	0	0	2		0.00	0671-98	0	
98-113-260-001	DIS-FLG 8X6-C	OB	6.00	0.00	0.00	6.00	10-	3	15	0	2	2		10.00	0671-98	0	
98-113-261-001	SUC-FLG 8X6-C	OB	2.00	0.00	0.00	2.00	10-	2	15	0	2	2		6.00	0671-98	0	
98-113-391-001	ST SHFT SLV10X4HD	OB	2.00	0.00	0.00	2.00	10-	3	9	0	0	2		51.78	0671-98	1	
98-130-361-007	NEOPRENE SLINGER	OB	9.00	0.00	0.00	9.00	10-	12	12	0	0	2		4.80	0671-98	0	
98-130-362-007	NEOPRENE SLINGER	OB	11.00	0.00	0.00	11.00	10-	1	12	0	0	2		3.00	0671-98	0	
98-130-362-010	NEOPRENE SLINGER	OB	10.00	0.00	0.00	10.00	10-	1	12	0	0	2		4.00	0671-98	0	
98-130-388-001	INSTRUCTIONPLATE	OB	48.00	0.00	0.00	48.00	10-	225	8	0	0	2		0.71	0671-98	0	
98-130-469-002	GASKET	DNR CB	7.00	0.00	0.00	7.00	10-	1	8	1	0	2		0.24	0671-98	0	
98-130-571-002	PACKING ANCHOR		15.00	0.00	0.00	15.00	10-	25	8	0	0	2		3.05	0671-98	0	
98-130-571-006	PACKING ANCHOR		1.00	0.00	0.00	1.00	10-	10	8	5	0	2		6.10	0671-98	0	
98-130-772-001	ST LUG 5X4	OB	15.00	0.00	0.00	15.00	10-	10	9	0	2	2		6.93	0671-98	0	
98-131-607-001	CIBRG PL 8X6SI	OB	7.00	0.00	0.00	7.00	10-	10	12	2	0	2		9.28	0671-98	0	
98-131-608-001	CIBRG PL 8X6SI	OB	3.00	0.00	0.00	3.00	10-	1	12	2	0	2		7.34	0671-98	0	
98-131-661-001	CIBRG PL 14X12SHN	OB	0.00	0.00	0.00	0.00	10-	1	12	6	0	2		10.87	0671-98	0	

FIGURE II-17

ALLIS-CHALMERS CANADA LIMITED

Figure II-1β represents the special stock status for special stock (SS) items whose order point = -20.

These parts are deleted as soon as the last item in stock is used.

ALLIS-CHALMERS CANADA LTD — SPECIAL STOCK STATUS - ORDER POINT = -20- — DATE 11/19/76 — PAGE 19

PART NUMBER	DESCRIPTION		TOTAL STOCK	QTY ON ORDER	QTY ON B.O.	AVAIL STOCK	ORDER POINT	EOQ	LD TM	USAGE TOT	USAGE QTY	FCST CODE	UNIT COST	LEDGER ACCOUNT	STK ADJ	ORD CDD
98-200-072-501	ROT-ELEM 12X10SRL	SS	1.00	0.00	0.00	1.00	-20-	1	10	0	0	2	849.50	0671-98	0	
98-200-123-501	ROT-ELEM 121025HMLSS		0.00	0.00	0.00	0.00	-20-	1	10	1	0	2	4367.96	0671-98	0	
98-234-761-501	CICASINGIZX3SSORM-SS		2.00	0.00	0.00	2.00	-20-	1	14	0	0	2	1110.75	0671-98	0	
99-331-771-001	NIHPREARSIDEPL	SS	1.00	0.00	0.00	1.00	-20-	1	14	0	0	4	0.00	0671-98	0	
99-331-807-501	BELTGUARD	SS	3.00	0.00	0.00	3.00	-20-	2	10	0	0	2	0.00	0671-98	0	
98-331-809-501	BELTGUARD	SS	5.00	0.00	0.00	5.00	-20-	2	10	0	0	2	0.00	0671-98	0	
96-332-179-903	SPECIALSUMRPLFORMBND		1.00	0.00	0.00	1.00	-20-	1	10	0	0	2	0.00	0671-98	0	
98-430-685-001	REDUCER	SS	1.00	0.00	0.00	1.00	-20-	2	10	0	0	2	0.00	0671-98	0	
98-431-469-002	BRIPESTGVAN30X2GSFSS		1.00	0.00	0.00	1.00	-20-	1	20	0	0	2	1988.00	0671-98	0	
98-530-883-50A	SPECIAL IMP 201-40SS		33.00	0.00	0.00	33.00	-20-	1	10	2	0	2	841.02	0671-98	0	

FIGURE II-18

ALLIS-CHALMERS CANADA LIMITED

II-8.4 Lacking Unit Costs

All parts in active ledger accounts should have a unit cost unless they have been recently added to the Parts File.

In order to verify this a program was written to scan the Parts File and print all part numbers whose unit cost equals zero.

Figure II-19 illustrates the print format of the program.

By inserting costs for part numbers which have some quantity in stock, the accuracy of the total recorded dollar value in each ledger account is increased. Similarly, customer orders involving these parts can be processed efficiently since the cost must be entered on the order.

DRAWING-NO	DESCRIPTION	FEDSTR	UNIT-COST
98-232-891-810	CG3M CASING 8X5X17	0603-31	.00
98-232-892-810	CG3MCASING6X6X17PW/V	0603-31	.00
98-232-894-807	CG3MCASING10X8X17PWD	0603-31	.00
98-232-894-810	CG3MCASING10X8X17PWD	0603-31	.00
98-232-980-810	CG3M CASING 14x12X21	0603-31	.00
98-232-982-810	CG3M CSG 16X14X21DWR	0603-31	.00
98-233-017-006	317SLVHARDFRKT111PWD	0603-32	.00
98-233-184-018	STDRGCOLLAR 14x12SHN	0603-31	.00
98-233-345-810	CG3M317SSSIDPL6X3X14	0603-31	.00
98-233-346-810	CG3MSTBOXCOVER BRKTI	0603-31	.00
98-233-466-023	STUDS 12X10X25HML NS	0603-98	.00
98-233-634-003	CF12MIMPWRRG14X12SHN	0603-31	.00
98-233-635-002	CI HALFGLAND14X12SHN	0603-31	.00
98-233-636-002	CI SEALCASE 14X12SHN	0603-31	.00
98-233-637-003	CF12MSHFTNUT14X12SHN	0603-31	.00
98-233-638-003	CF12MSHFTNUT14X12SHN	0603-31	.00
98-233-639-002	CIST8OX8USH 14X12SHN	0603-31	.00
98-233-831-002	CF12MIMP.ROTH14X12SH	0603-31	.00
98-233-834-003	CF12MCSGKERH14X12SHN	0603-31	.00
98-233-835-002	CF12MIMPRGLH14X12SHN	0603-31	.00
98-233-836-003	CF12MCSERELH14X12SHN	0603-31	.00
98-234-533-040	HALFCLAMP121025HMLOB	0671-98	.00
98-234-533-055	HALFCLAMP121025HMLOB	0671-98	.00
98-234-547-001	316SLOWHALFGLNDBRKTI	0603-31	.00
98-234-547-002	316SUPPHALFGLNDBRKTI	0603-31	.00
98-234-600-808	CG3MCASG 12X10X21PWD	0603-31	.00
98-234-600-810	CG3MCASG 12X10X21PWD	0603-31	.00

FIGURE II-19

II-8.5 Critical Parts Report

Over 7,000 customer orders are processed per year by Allis-Chalmers resulting in approximately 400 open allocations at any given time.

Similarly, several hundred replenishment orders are open at any given time for stock. These may be shop orders or purchased finished parts.

It is desirable to ensure that priority is placed on closing replenishment orders for which there are open allocations.

Not only does this improve service by reducing open allocations, it also prevents unneeded orders from being closed and placed into inventory.

To achieve this objective the Critical Parts Report shown in Figure II-20 is used.

Individual reports are issued for each "inventory code" (i.e. by product).

Within each report, priority is established by subtracting the quantity allocated from the quantity in stock, and listing the parts in descending order of negative availability.

The data listed in Figure II-20 is as follows:

PART NUMBER — a drawing number describes each part.

ALLIS-CHALMERS CANADA LTD CRITICAL PARTS - 02 ICOSPR03 02/25/77 PGE 1

--PART-NUMBER--	- D E S C R I P T I O N -	TOTAL STOCK	QTY ALLOC	AVAIL STOCK	QTY-ON ORDER
98-234-063-001	PED-1 JACKSCREW	15	136	121-	300
98-331-272-501	CST-RUNN-SKEL5X4 C	3	124	121-	240
98-331-830-501	10X8-RUN-SKEL-SCREW	69	186	117-	225
98-211-651-501	2X1 IMPELL SKELETON		116	116-	250
98-110-457-501	10X8-GLAND-SKEL	32	132	100-	250
98-331-769-501	10X8 RUN-SKEL-KEY	8	100	92-	200
98-211-409-001	CIA STUFF-SKEL10X8 C	65	132	67-	265
98-211-477-501	10X6-SUCT-SKEL	56	120	64-	150
98-531-747-001	IMP-SK L 12X10X2SSRL	2	59	57-	55
98-331-731-001	PED-2 CYLINDER	4	60	56-	110
98-331-441-001	SK4 SUCT-LIN-SKEL	27	75	48-	65
98-331-446-501	2X1 GLAND-LIN-SKEL	4	51	47-	200
98-331-844-501	8X6-RUN-SKEL-SCREW	16	60	44-	100
98-331-912-001	PED-3 CYLINDER	8	50	42-	80
98-431-854-501	PED-1 SHAFT	1	42	41-	80
98-331-926-001	PED-2 END COVER THR	12	51	39-	100
98-331-126-801	SHAFT-SLEEVE 2X2	1	35	34-	140
98-331-93[illegible]-501	PED-2 SHAFT		32	32-	70
98-231-114-501	SK4-G-GLAND-LIN-NAT	2	32	30-	70
00-813-261-385	TCAR LRG 22212 RAD	22	51	29-	
98-431-641-501	10X8-RUN-SCREW NAT	26	55	29-	186
00-813-261-389	TCAR LRG 22312 RAD	23	51	28-	
98-331-958-801	PED 1 SHAFT SLEEVE	19	47	28-	160
98-531-594-001	PED-2 PEDESTAL	1	29	28-	66
98-234-109-001	CI SHAFT SLV 2X2	43	70	27-	200
98-331-954-001	P D-3 END COVER RAD	24	51	27-	130
98-110-691-001	CIA-GLAND 2X2	6	32	26-	130
98-234-904-501	US 98331825501	13	39	26-	30

FIGURE II-20

DESCRIPTION	brief description of part.
TOTAL STOCK	number of finished units in stock.
QTY ALLOC	number of units allocated to customer and other dependent shop orders.
AVAIL STOCK	total stock minus qty allocated.
QTY ON ORDER	number of units on order from the shop or a supplier.

This report is distributed to the Purchasing and Scheduling Departments as a guide to expedite replenishment stock orders.

II-8.6 Inventory Summary For Assembly of Pumps

The Inventory Summary Report was originally developed to assist Production Scheduling. Prior to its implementation a copy of a manually produced Bill of Material was used by the warehouse to stage available stock for assembly, well in advance of the required date. Another copy was forwarded to the Production Scheduling Department who tediously scanned the Stock Status part by part and began expediting shortages.

By setting up a card deck in structural or Bill of Material sequence and extracting an Inventory Summary from the Stock Status, Production Scheduling could effectively identify shortages without needlessly staging material.

Marketing soon embraced the report as a means of quoting delivery dates on existing, as well as, potential orders.

Inventory Control Personnel immediately spotted and adjusted obvious errors such as mismatched order points and forecast codes, and open orders which had been closed. The subtle effects of poor discipline were revealed using the new summary.

Referring to Figure II-21, sheets 1 to 3, the inventory summary format lists all the parts which form a complete 12 X 10 X 25 SRL-C pump. The headings are as follows:

CARD NO. — a card number is assigned to every part number since the report is desired in card number sequence rather than part number sequence.

ALLIS-CHALMERS CANADA LTD ICCSIRJ4 — INVENTORY SUMMARY — .C09 12 X 10 X 25 SRL-C PUMP — DATE 02/17/77 — PAGE 1

CARD NO	--PART-NUMBER--	-----DESCRIPTION-----	QTY PER	TOTAL STOCK	QTY-ON ORDER	QUANTITY-ALLOCATED CUST	ASSYS	TOTAL	AVAIL STOCK	ORDER POINT	ECQ	LD TM	TOTAL USAGE	FORECAST QTY	CD	SOURCE IDENT
0000	98-200-144-501	COMPL-PUMP 12X10X25		2	9	6	0	6	5	4	1	16	10	1.0	4	* UNIT NO.
	SOURCE NO	212460	222460	232460												
	QUANTITY	3	3	3												
	DUE DATE	31		26												
0105	98-432-100-501	GLAND-HALF CSG 12X10X25	1	9	5	0	9	9	5	4	3	16	16	1.0	1	
	SOURCE NO	224693														
	QUANTITY	5														
	DUE DATE	37														
0110	98-432-102-501	SUCT-CASING 12X10X25	1	1	16	0	9	9	8	6	3	16	14	2.0	4	
	SOURCE NO	232464	242464	252464												
	QUANTITY	7	6	3												
	DUE DATE	33	35	26												
0115	98-530-389-501	PEDESTAL 12X10-C	1	8	12	0	9	9	11	10	3	16	15	2.0	1	
	SOURCE NO	486360	496360	506360												
	QUANTITY	4	4	4												
	DUE DATE	34	37	12												
0120	98-430-949-831	FRG-CYL 12X10-C	1	10	12	0	8	9	13	10	13	16	19	2.0	1	
	SOURCE NO	326364														
	QUANTITY	12														
	DUE DATE	32														
0125	98-432-133-501	SHAFT-ASSY 12X10HML	1	7	15	0	9	9	13	3	9	12	16	1.0	1	
	SOURCE NO	152410														
	QUANTITY	15														
	DUE DATE	25														
0130	98-234-838-001	CTA SHF SLV 12X10X25C	1	24	30	6	17	23	31	32	30	16	76	5.0	1	
	SOURCE NO	152451														
	QUANTITY	30														
	DUE DATE	6														
0135	98-431-978-501	BRG-COV-ASS-12X10HML	1	11	15	0	9	9	17	15	10	16	28	3.0	1	
	SOURCE NO	152405														
	QUANTITY	15														
	DUE DATE	12														
0140	98-432-126-501	BRG-COVER-ASS-12X10H	1	4	30	0	9	9	25	9	30	16	21	4.0	4	
	SOURCE NO	102406														
	QUANTITY	31														
	DUE DATE	5														

FIGURE II-21, SHEET 1

ALLIS-CHALMERS CANADA LIMITED

ALLIS-CHALMERS CANADA LTD ICOSMP04 INVENTORY SUMMARY DATE 02/17/77 PAGE 2

--- COG 12 X 10 X 25 SRL-C PUMP ---

CARD NO	--PART-NUMBER--	-----DESCRIPTION----	QTY PER	TOTAL STOCK	QTY-ON ORDER	QUANTITY-ALLOCATED CUST	ASSYS	TOTAL	AVAIL STOCK	ORDER POINT	EOQ	LD TM	TOTAL USAGE	FORECAST QTY	CD	SOURCE IDENT
0205	98-234-838-001	GLAND 12X10HML	2	22	60	0	34	34	48	31	40	16	72	4.0	1	
	SOURCE NO 182416 192416															
	QUANTITY 30 30															
	DUE DATE 12 23															
0210	98-234-8[illegible]-001	WATERSEALBUSH 12X10H	1	13	40	0	17	17	36	24	40	16	36	4.0	1	
	SOURCE NO 182409															
	QUANTITY 40															
	DUE DATE 42															
0215	98-231-7[illegible]-517	DEFLECT 12X10HML	1	6	30	0	9	9	27	25	28	18	27	4.0	1	
	SOURCE NO 182427															
	QUANTITY 33															
	DUE DATE 13															
0220	98-332-231-801	STUFF-BOX 12X10HML	1	3	30	0	17	17	16	10	10	16	22	2.0	1	
	SOURCE NO 182415 192415 202415															
	QUANTITY 10 10 10															
	DUE DATE 31 12 22															
0230	00-813-261-625	TORR BRG 110 RADIAL	1	10	0	1	9	10	0	0	11	4	23	4.0	4	
0235	00-813-261-627	TORR BRG 110 THRUST	1	12	0	1	9	10	2	0	8	4	23	4.0	4	
0305	98-530-742-501	IMPELLER 12X10X25NAT	1	17	19	32	9	41	5-	27	10	8	75	7.0	1	
	SOURCE NO 63939															
	QUANTITY 19															
	DUE DATE															
0310	98-530-740-501	IMP-SKEL 12X10X25SEL	1	2	40	19	0	19	23	25	10	16	33	5.0	4	
	SOURCE NO 182472 172472															
	QUANTITY 20 20															
	DUE DATE 40 10															
0315	98-234-931-501	SUC LIN 12X10X25 NAT	1	29	18	30	9	39	8	28	10	8	88	8.0	1	
	SOURCE NO 63939															
	QUANTITY 18															
	DUE DATE															
0320	98-332-152-801	SUC LIN SKEL12X10X25	1	28	25	18	0	18	35	24	25	14	77	8.0	4	
	SOURCE NO 202458															
	QUANTITY 25															
	DUE DATE 17															
0325	98-278-[illegible]-501	USE 9533.625601	1	13	30	30	9	39	4	1-	10	8	97	8.0	1	

FIGURE II-21, SHEET 2

ALLIS-CHALMERS CANADA LIMITED

ALLIS-CHALMERS CANADA LTD IC05PR64 INVENTORY SUMMARY DATE 02/17/77 PAGE 3

--- COG 12 X 10 X 25 SRL-C PUMP)---

CARD NO	--PART-NUMBER--	-----DESCRIPTION----	QTY PER	TOTAL STOCK	QTY-ON ORDER	QUANTITY-ALLOCATED CUST	ASSYS	TOTAL	AVAIL STOCK	ORDER POINT	EOQ	LD TM	TOTAL USAGE	FORECAST QTY	CD	SOURCE IDENT
	SOURCE NO 63839															
	QUANTITY 30															
	DUE DATE															
0330	98-332-267-801	GLA LIN SKEL12X10X25	1	4	0	30	0	30	26	1	30	14	68	5.0	4	
0335	98-332-248-501	GL-WR-PL12X10X25 NAT	1	23	11	20	9	29	5	23	10	8	68	6.0	1	
	SOURCE NO 63939															
	QUANTITY 11															
	DUE DATE															
0340	98-332-243-501	GL-WR-PL-SK 12X10X25	1	28	0	11	0	11	17	10	30	12	38	5.0	4	
0345	98-332-251-501	SU-WR-PL12X10X25 NAT	1	20	25	20	9	29	16	27	10	8	84	7.0	1	
	SOURCE NO 49909															
	QUANTITY 25															
	DUE DATE															
0350	98-332-444-031	SU WR PL SK 12X10X25	1	21	40	25	0	25	36	30	15	16	53	3.0	4	
	SOURCE NO 172470	172470														
	QUANTITY 20	20														
	DUE DATE 10	19														

FIGURE II-21, SHEET 3

ALLIS-CHALMERS CANADA LIMITED

PART NUMBER	a drawing number describes each part.
DESCRIPTION	a brief description of each part.
QTY PER	the number of units in a complete assembly.
TOTAL STOCK	the number of units in stock.
QTY ON ORDER	the number of units on order from the shop or a supplier.
QUANTITY ALLOCATED	
CUST	independent demand allocations.
ASSYS	dependent demand allocations on unit for higher level assemblies.
TOTAL	total number of units allocated to customers and assemblies.
AVAILABLE STOCK	(total stock + qty on order - total quantity allocated).
ORDER POINT	the order point.
EOQ	the economic order quantity.

LD TM	the lead time in weeks.
TOTAL USAGE	the total annual usage.
FORECAST QTY	the forecast usage per month.
FORECAST CDE	the "part code" from the Parts File.
SOURCE IDENT	a user defined alpha-numeric field except for "*unit no." which defines the final assembly unit.

In Figure II-21, Sheet 1, it is noteworthy that there are two complete pumps (98-200-144-501) in stock, but six pumps have been allocated to customers. Hence Scheduling would immediately begin expediting the next two shop orders for 3 pumps each. The "source number" indicates the shop or purchase order required for each part. (Note: the 212460 is an abbreviation for shop order no. 3-9821-2460 previously explained.)

EXAMPLE:

In order to complete the first order, 212460, for 3 pumps originally due on week number 31, a quick scan down the "total stock" column on Page 1 indicates that there is only 1 "suct-casing", part number 98-432-192-501, in stock. Therefore shop order 232464 for 7 units due week 33 must be completed in order to satisfy the next three pumps on order.

The example above demonstrates how the Inventory Summary allowed Production Scheduling to work on matching components before they reached crisis proportions without staging material.

The dotted lines across the page are used to define various structural levels or groupings by incrementing the first two digits of the "card number".

The segregation of independent demand backlogs, however, also gave new perspective to the limitations of order point control in a manufacturing environment.

III - PROPOSED SYSTEM ENHANCEMENTS

III-1 USAGE REPORT

III-2 ABC REPORT

III-3 INVENTORY FORECAST

III-4 MATERIAL REQUIREMENTS PLANNING (MRP)

III-1 USAGE REPORT

The parts master file contains twelve accumulators to store the last twelve months usage. Each month the inventory usage program advances the monthly usages by one month dropping the oldest usage. Then the current month's usage (= demand) is moved into the first accumulator.

Recording usage by this method contributes to usage instability. Any factor which causes an abnormally high or low volume of orders to be processed in one month will cause higher deviation and thus higher safety stock.

Examples of this would be:

(i) a mail strike - lowers usage
(ii) the annual vacation shutdown in July (2 weeks) - lowers usage
(iii) employee sickness - lowers usage
(iv) working overtime to reduce order backlog - increases usage

To correct this, a solution would be to change the inventory update program to consider the date entered on an order, transpose this date to month of year, and update the correct month's usage accumulator.

This will project a truer picture of monthly requirements and yield savings by calculating reduced inventory levels.

III-2 ABC REPORT

The ABC program is functioning well, however, the method of reporting requires some modifications.

Firstly, the report is generated by ledger account. Since there are 14 different "active" ledger accounts, the 2400 parts on file which are turning over are subdivided and categorized on 14 separate reports.

This results in 14 lists of A items which number over four hundred parts. It becomes very difficult to focus attention on these parts because they are too numerous and there are too many reports.

To reduce the number of reports to two or three the program should be modified to re-group the items by product inventory code which is already available on the Parts File.

Secondly, the combination of usage and unit cost is such that 15% of the file qualify as A items. It would be an improvement to redefine A items as the top 60% of the total dollar value of annual usage since this would result in only 7% qualifying as A items.

Thus A [redacted]ms would total approximately 150 and could justify receiving a special monthly review to ensure stock outs are kept to a minimum.

Additionally, a physical count could be made each quarter to maintain record accuracy.

III-3 INVENTORY FORECAST

The current system groups parts into three categories by a field called "part code".

"Part code 1" are active parts with minimum usage and stability so that their order points can be calculated by the exponential smoothing portion of the forecast program.

"Part code 2" are inactive parts and are not managed by the Inventory Control System.

"Part code 4" are active parts whose order points are manually set.

There are approximately 3400 items in the pump, mining, and compressor product lines.

In this total, 15% are part code 1, 30% are part code 2, and 55% are part code 4.

This means that within the active parts, 21% have one order policy set by the existing exponential smoothing program, and the remaining 79% are manually set.

It is proposed that the two active "part codes" be replaced by more categories and establish an order policy for each category keeping in mind inventory investment and customer service.

The purpose of these categories is to:

(i) increase the service level on some parts keeping cost to a minimum.

(ii) decrease the service level on other parts resulting in maximum savings.

(iii) increase the total number of parts whose order point can be efficiently regulated by a forecast program.

Each part would pass through a "filtering step" to assign it to one of five new categories based on usage, re-order cost, and stability:

III-3.1

Usage is the cumulative monthly demand for the previous twelve months. Low, moderate, and high usage are defined as follows:

low usage = less than 10 units per year

moderate usage = 10 to 100 units per year

high usage = over 100 units per year

III-3.2

Re-order cost equals EOQ times unit cost which is used to place importance on the relative annual cost of carrying the item.

low re-order cost = less then $250

moderate re-order cost = $250 to $2,000

high re-order cost = over $2,000

III-3.3

Stability can be simply defined as a measure of how closely the item approaches straight line demand.

In this case it is proposed that stability be checked by comparing the ratio of the Average Absolute Deviation per month to the Average Usage per month.

The lower the ratio, the more stable the item behaves.

$$\text{Stability Ratio} = \frac{\text{Average Absolute Deviation per month}}{\text{Average Usage per month}}$$

$$= \frac{\sum_{\text{Last 12 Months}} [\text{Actual Consumption} - \text{Forecast}]}{\text{Current Annual Usage}}$$

Using Figure II-7, the usage report for Inventory Code 2, Part Code 1 and taking part number 98-231-134-501, we can compute the Stability Ratio:

Monthly usage:

28, 24, 19, 32, 22, 10, 19, 32, 50, 14, 24, 62

Total usage: 336

Forecast usage: 30

For month #1: [Actual Consumption-Forecast] = [28-30]
= 2 (Made Positive)

Similarly the absolute deviations for all twelve months are:

2, 6, 11, 2, 8, 20, 11, 2, 20, 16, 6, 32 for a total of: 136

Therefore, Stability Ratio = $\frac{136}{336}$ = 0.405

Several additional examples of parts behaviour were taken and their Stability Ratios were calculated. From these results, low, moderate, and high stability can be defined as follows:

low stability: Stability Ratio > 1

moderate stability: $0.5 \leq$ Stability Ratio ≤ 1

high stability: $0 \leq$ Stability Ratio < 0.5

III-3.4

The five new order policy categories are defined as follows:

Categories 1, 2 & 3: The order point will be calculated and automatically revised by a computer forecast program with each category having its own safety factor to provide different degrees of safety against stockouts.

The same exponential smoothing formula described in Chapter I, Section 5 would be used except the safety factor would change.

Category 1: Safety factor = 2.0 to provide a high customer service level (98%).

Category 2: Safety factor = 1.0 to provide a moderate customer service level (84%).

Category 3: Safety factor = 0.8 to provide a low customer service level (79%).

Category 4: Will employ a simple linear formula:

$$\text{Order Point} = \left(\frac{\text{Lead Time (wks)}}{52} \times \text{Annual Usage}\right) \times 1.5$$

Since demand is not linear, 1.5 represents an arbitrary safety stock factor.

The order point will be rounded up to the next whole number.

In this case, order point changes would be proposed by the computer but not changed without management approval.

This category will be employed for items whose usage is too low for categories 1 to 3 and whose unit cost is low to moderate. Stability is not considered in this case.

Category 5: Is assigned to items with low usage and high unit cost. Order points in this category are set manually.

Figure III-1 demonstrates how the combination of usage, reorder cost, and stability determine which forecast category is assigned to each part.

All parts selected for categories 4 & 5 would be subject to an additional usage check as shown in Figure III-2.

The purpose of this step is to move items into category 4 if their usage is trending upward so that the order point may be reviewed for a possible increase. Similarly, parts assigned to category 4 which are trending downward should be moved to category 5.

FORECAST CATEGORY BASED ON ANNUAL USAGE, RE-ORDER COST, AND STABILITY

ANNUAL USAGE	RE-ORDER COST	STABILITY	FORECAST CATEGORY
LOW	HIGH	-	5
LOW	LOW, MODERATE	-	4
MODERATE	MODERATE, HIGH	LOW	3
HIGH	HIGH	LOW	3
MODERATE	MODERATE, HIGH	MODERATE, HIGH	2
HIGH	HIGH	MODERATE, HIGH	2
HIGH	MODERATE	-	2
MODERATE	LOW	-	2
HIGH	LOW	-	1

FIGURE III-1

MOVEMENT BETWEEN CATEGORY 4 AND CATEGORY 5 BASED ON USAGE

DOES PART HAVE ANY USAGE IN THE LAST NINE MONTHS?	YES	YES	NO
DOES PART HAVE USAGE IN 4 OF THE LAST 6 MONTHS?	NO	YES	-
IF IN CATEGORY 4, MOVE TO 5.	X		X
IF IN CATEGORY 5, MOVE TO 4.		X	

FIGURE III-2

III-4 MATERIAL REQUIREMENTS PLANNING (MRP)

During the author's three year tenure of enhancing the order point inventory control reports into a workable, meaningful system, other departments at Allis-Chalmers had embarked on computerized systems as well. Purchasing, Scheduling and Process Planning had either purchased software or had developed "in house" systems to aid their various functions.

The next step is to fully integrate these separate systems using data now available. As this represented a formidable task for our Data Processing Department, tenders were issued this year for a software package which would handle all the files, and link them into a sophisticated manufacturing control system.

Material Requirement Planning, commonly called MRP, was recently chosen as it offered several solutions to problems inherent in using order points in a manufacturing environment.

The problem of handling dependent and independent demand had become obvious when the "Inventory Summary for Assembly of Pumps" Report was first implemented. With some twenty finished components required for a standard pump assembly, and a service level of 84% on each part, the mathematical probability of achieving matched sets of components for assembly purposes was almost nil.

Although the "Inventory Summary" was successful in highlighting shortages before they reached critical proportions, it was not dynamic enough to highlight those orders which should have been deferred. Hence we found that production of pump assemblies increased but that inventories of raw material also rose because priority orders identified in the summary took precedence.

Those familiar with MRP know that it is a priority planning system constantly revising requirement dates to match constraints such as material delivery and capacity. Time phasing "dependent" demand and inserting forecasted "independent" demand should achieve desirable inventory levels.

Like the Kardex System, the Order Point System discussed in this study has served its users well. The author believes that the reports comprising this study offer guidance to other firms who may be contemplating installing or enhancing an Order Point Inventory Control System.

IV - CONCLUSION

Enhancing any system should be a continuous responsibility to keep pace with changing needs. The pressures to modernize business procedures are evident with the fast, efficient application of computer systems.

Equipped with this purpose, the author invited the participation of his staff to identify problems and discuss solutions to upgrade the subject inventory control system.

Previously, the transition from Kardex to a basic computerized order point system had been completed. It became the author's role as user of the system, to lead the Company through changes which resulted in an expanded and comprehensive system as outlined in this report.

The current plan to implement a Material Requirements Planning System is further indicative of the role played by Management in today's business.

User support and participation must be present to ensure that proposed system changes meet expectations.

A comprehensive system's policy is also mandatory to ensure the necessary disciplines are present, particularly during staff change-overs.

Recognizing the objectives and limitations of the system is also important, not only to the staff, but to Management as well. In this regard, many of the enhancements outlined in this report delt with the daily function of the inventory control staff. While this improved staff resource utilization, it did not provide a cure for all delayed shipments or unsold inventory.

The limitation of order point control in a manufacturing environment is now clear with the advent of Material Requirements Planning.

Understanding the content of this study will assist the reader in assessing his inventory control needs. More importantly, it provides valuable assistance during implementation.

APPENDIX A

Major system improvements in chronological order:

1. Addition of a Usage Report providing current last 12 months usage by month. (Page 78-86).

2. Combination of Inventory Stock Status with the original Customer/Shop Order Report. (Page 43, para. I-6.2.3; Page 54, Page 62-63).

3. Complete revision of the Shop Order Approval Card and the system of approval. (Page 43, para. I-6.2.4; Page 59-61).

4. Re-organizing the existing inventory "part codes" to restrict automatic adjustment of order points to parts whose usage behaviour could be properly handled by exponential smoothing. (Page 47, para. I-6.5; Page 64-68).

5. Replacement of the Requisition Run with an order indicator system employing an asterisk (*) on the Stock Status. (Page 45, para. I-6.3; Page 56-58, para. II-2.2.3 (vi)).

6. Addition of an Annual Physical Inventory report package linked to the existing Inventory Stock Status and Parts File Listing. (Page 87-89).

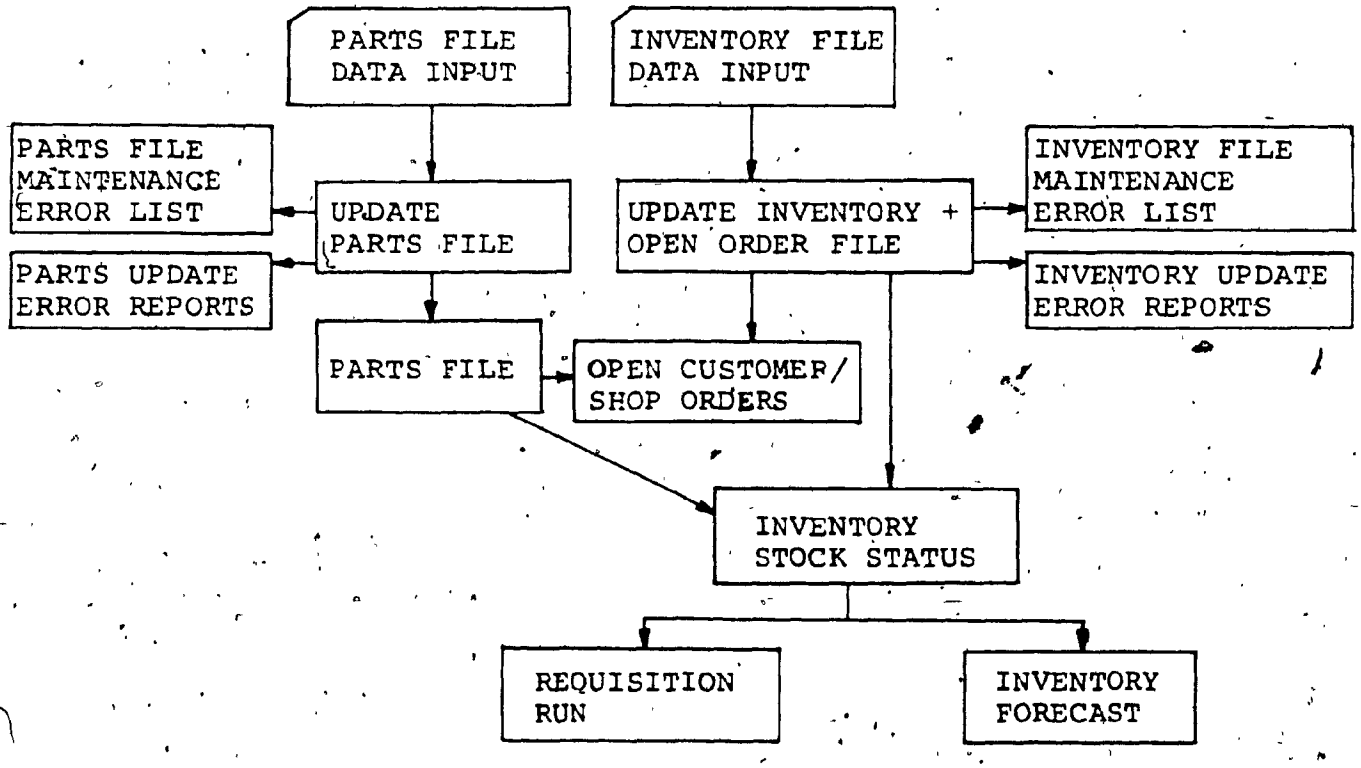
7. Addition of various analysis reports: ABC Report, Surplus Report, Obsolete Report, Lacking Unit Costs, Critical Parts Report, and Inventory Summary for Assembly of Pumps. (Page 90-118).

8. Addition of New Year to Date Closed Customer/Shop Orders Report providing cumulative closed order information between annual physical inventory counts. (Page 69-71).

9. Addition of a Calculated Economic Order Quantity Report. (Page 72-77).

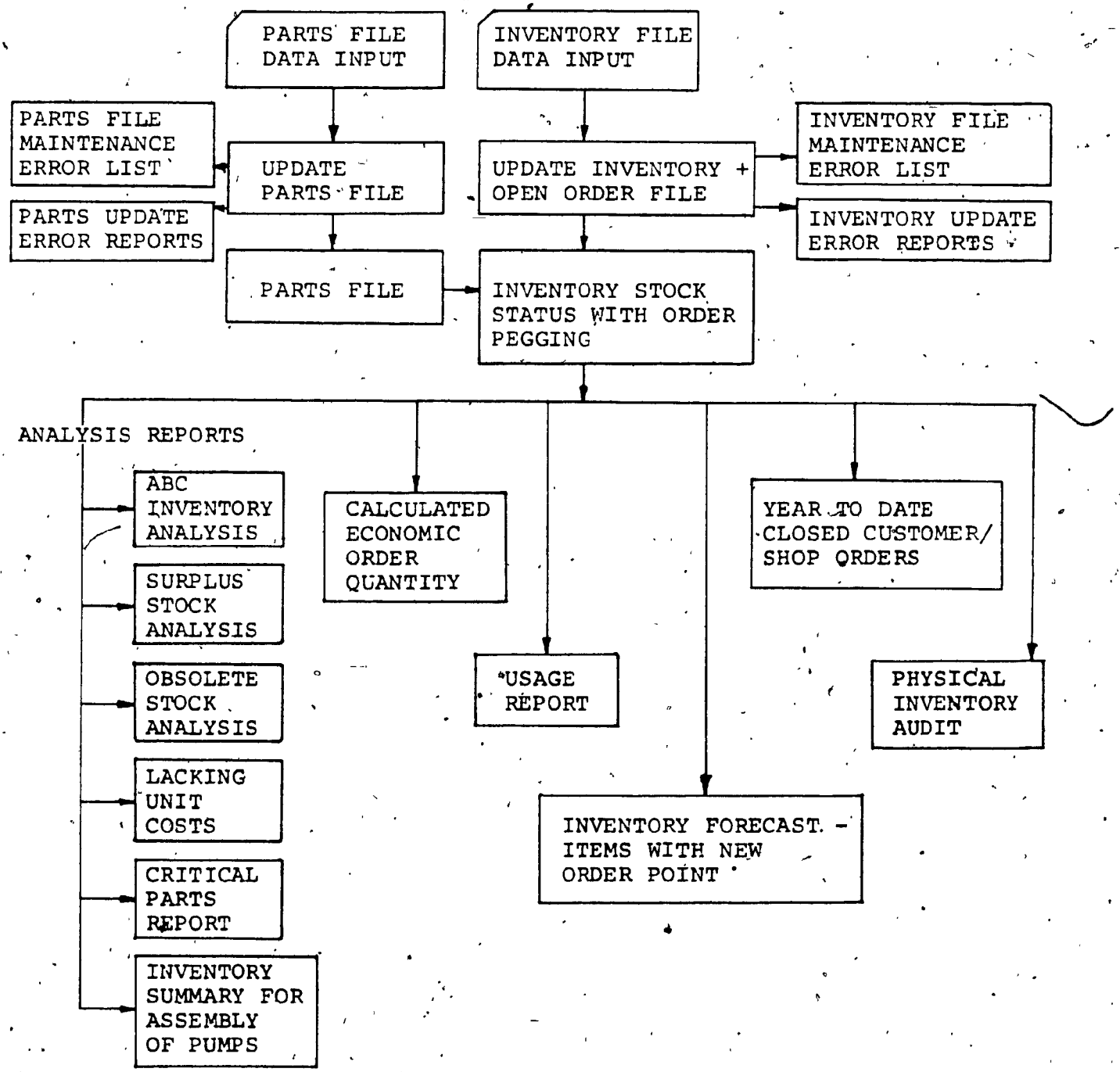
APPENDIX B

ORIGINAL SYSTEM REPORT BLOCK DIAGRAM



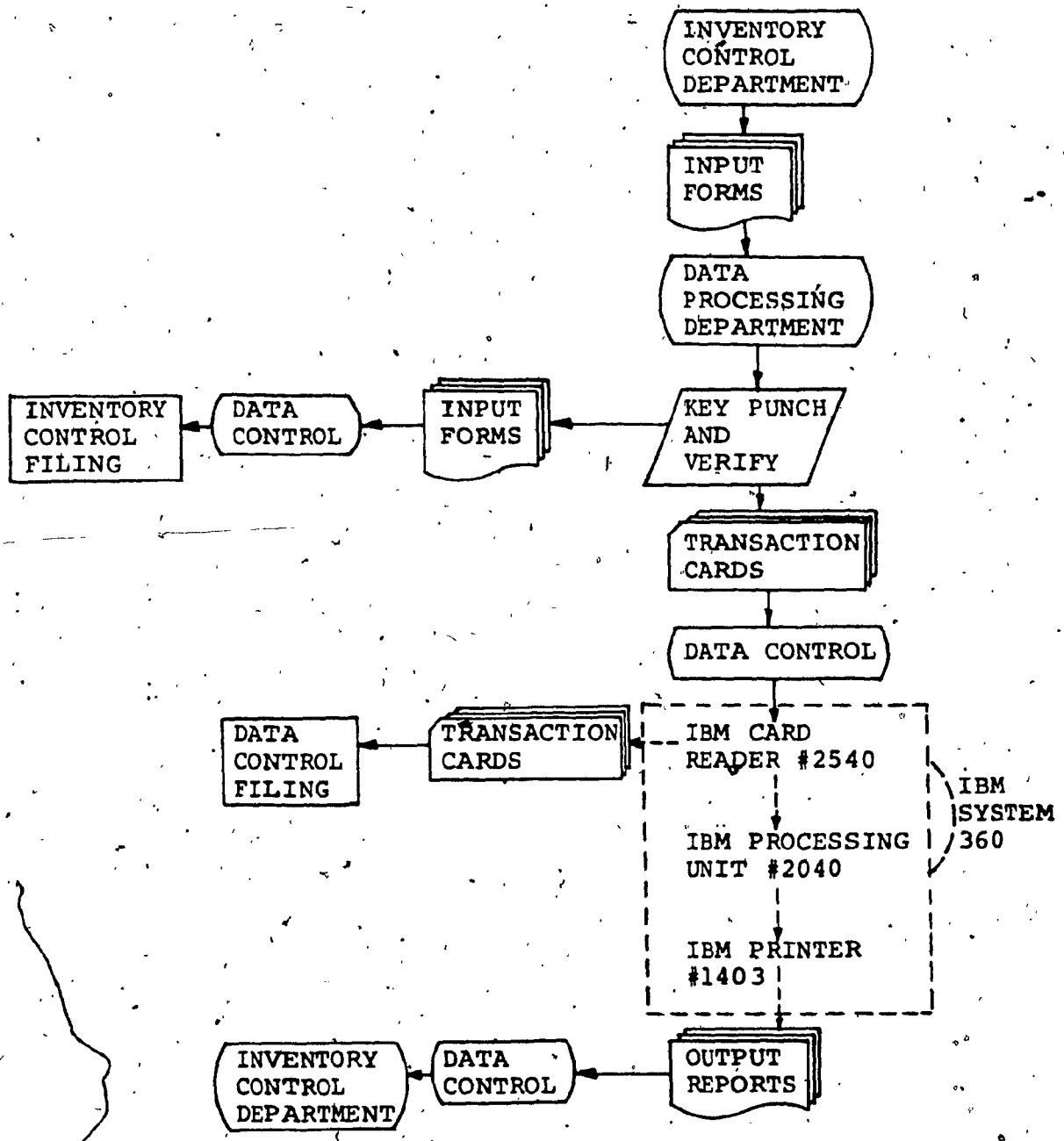
APPENDIX C

CURRENT SYSTEM REPORT BLOCK DIAGRAM



APPENDIX D

COMPUTER SYSTEM OPERATIONAL STRUCTURE



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